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FUSING THE NEUTRAL WIRE.

The insertion of a fuse in an electric circuit limits the load which may be placed upon that circuit and limits the duration of a short-circuit between the two leads. It also serves to interrupt the circuit in case of a ground upon the portion protected, provided there is also a ground, intentional or accidental, upon some other portion of the circuit having a potential substantially different from that of the first grounded portion. Except for the latter contingency it would answer just as well to fuse one as to fuse both leads of a two-wire circuit. It was formerly general practice to fuse all three leads of an Edison three-wire circuit, and this practice is still common in many localities. If the neutral wire were not grounded it would be good practice, for the reason indicated above. But with a grounded neutral there is no necessity for protecting the middle wire against grounds, and the fuses in the outside wires afford protection against short-circuits.

In recognition of this fact the 1913 edition of the National Electrical Code permitted the middle wire of a three-wire system with grounded neutral to be continuous and unfused. The recent revision has gone a step further and made it mandatory to omit this fuse.

This change is an excellent one. The neutral fuse is not only unnecessary but in certain conditions may actually introduce a hazard. The blowing of the neutral fuse may disconnect the middle wire of a portion of a system, resulting not only in unbalancing the voltages on the two sides of the system, but in case of a short-circuit on one side putting double voltage on the other side. This may not only injure lamps and other apparatus through overloading, but may heat some device to the point of creating a fire hazard. Where the neutral wire has a separate ground connection on the load side of the fuse, the above cannot take place, but the result may be that the neutral current will take a return path through the ground connection. This is itself an undesirable condition.

English practice has been better than American practice on this point. In Great Britain general practice is to make solid connection to the neutral, no fuse being introduced in this lead. For some time now grounding of the neutral wire on both direct and alternating three-wire systems has been mandatory in this country, and it is only logical to also make mandatory the omission of the neutral fuse. This is now a Code rule.

SIDELIGHTS ON DIRECT-CONNECTED MOTOR DRIVING.

With the increased use of direct-connected motors in driving power tools, engineers are finding out many interesting points bearing upon service efficiency. The part which mechanical problems play in successful motor applications is sometimes overlooked by electrical men, with the result that service interruptions and losses in energy occur which might readily be avoided. This is not to discredit the electric drive in any way, for it is the ideal method of tool propulsion; but to get the very best results from a given installation it is necessary to analyze the conditions with a good deal of care.

For example, a considerable amount of difficulty has arisen in the past from the lack of flexible couplings, in cases where the motors have been mounted directly in line with or upon the main driving shafts of the tools. Even where the user has gone to the trouble of mounting the motor with its shaft and rigid coupling upon a separately cast base holding the journal boxes firmly in position, unequal wear of bearings has given trouble. There is real need of an adjustable motor bearing for general industrial service, considering the narrowness of air gaps now employed. In many an industrial plant, the cost of unequal wear of bearings through failure to use flexible couplings, even where the motor and shaft speeds are the same, easily may run up to from $35 to $75 per interruption. When the rotor of an induction motor gets off-center through unequal wear, it tends toward uneven distribution of flux, with resulting loss of efficiency, and if the bars finally collide with the stator poles, the mechanical and electrical damage may be considerable. A little "play," therefore, between motor shaft and driven machine is very much worth while, and in the great number of geared and belted installations which one finds in going about factories, this flexibility is fortunately present.

Direct connection has the advantage where speeds permit of notable reductions in friction losses, compared with previous conditions. Thus, in one case where two 60-inch fans were belt-driven, a 40-horsepower induction motor was required, whereas when rearranged with a motor between the two fans and on the same shaft, a 25-horsepower motor met the requirements. In this case no flexible coupling was needed, for the reason that the strains were uniformly distributed over the entire cycle of fan rotation. The only point was to make sure of the alignment of the bearings, giving minimum shaft friction. In this connection, the importance of avoiding extremely short belt drives is worth mentioning. Experience shows that in some cases where such belts have been used, the energy consumption of a tool has been greater when running idle than when performing its operations. The mounting of motors directly upon the frames of lathes, shapers, etc., has been a good thing from this point of view.

More extended studies of the power requirements of tools are desirable, in the interests of reducing superfluous investment in motor capacity and also in running motors as much as possible upon their range of higher efficiencies. Sometimes it pays to subdivide the motor drive upon a tool, even though the combined rating of the new arrangement exceeds that of the old. Thus, in a recent instance where a machine tool was driven by a five-horsepower motor through two quarter-turn belts, the motor being mounted on a central shaft a short distance away from the machine proper, it has been decided to substitute two three-horsepower motors, one for each belt drive, and to replace the quarter-turns by direct belting through the use of vertical-shaft motors. In this instance the reduction in friction losses through being able to use either one or two motors as the load requires, and the corresponding savings in energy, will make the change a good one. In another instance it was found that if a squirrel-cage motor with welded secondary bars had been used in place of the customary soldered bars, the service could be performed by three-horsepower instead of five-horsepower units. Proper fitting of motors to tools is very important, not only with respect to initial outlay, but also in relation to generating capacity. Thus, in a plant driven by a 150-kilowatt unit it was found when induction motors were first placed in service that the generator became unduly heated, despite the fact that there was no sign of heavy loading at the engine. Investigation disclosed that many of the tools were over-powered, leading to so much wattless current that the capacity of the generator was greatly reduced. A rearrangement of the load, with changes in motor distribution throughout the plant, remedied the situation. All of these points go to show the value of thorough analysis in planning and maintaining electrically driven machinery.

THE WHEEL TAX.

The wheel tax is an established institution in many communities in this country. It was customary to tax horse-drawn vehicles before the advent of the motor vehicle, and since the latter has appeared on the scene, there is frequently a disposition not only to accord it the same treatment, but to burden it with a still higher tax. If there is any philosophy whatever behind such a procedure, it is certainly one with little logical foundation. The wear and tear of solid rubber or pneumatic tires upon paved roadways is usually much less than for the same number of car-miles with steel-tired wheels. In city streets the enormous budgets for street cleaning are to be very largely debited to the horse. Not only does the horse traffic add very largely to the expense of street cleaning, but it is also objectionable from the standpoint of hygiene, as much of the filth occasioned is blown into the air before there is time for its removal. According to many authorities, this condition is quite deleterious to health.

On account of these two considerations, it would seem that the motor vehicle should be encouraged by a smaller tax than is imposed upon the horse-drawn vehicle, if indeed there is to be any tax at all. It is well recognized that the effect of a tax is to discourage the use of the thing taxed. It is with this idea in view that taxes are imposed upon such things as dogs and the liquor business. If it is public policy to encourage any development, taxes should not be imposed in such a way as to hinder that development. Since, from the standpoint of both public expense and hygiene, a motor vehicle is to be preferred to a horse-drawn vehicle, it would seem reasonable to abolish the taxes upon the former.

As between electric and gasoline motor cars, there is but little choice on this score, but the slight difference is in favor of the electric, since it does not offend by pouring into the atmosphere any objectionable fumes. While the exhaust from the gasoline motors used in the streets is usually so quickly diluted as to represent no hazard to health, it is conceivable that motors of this type might become so numerous as to have an appreciable effect of this kind. At any rate, the electric vehicle is free from such indictment.

CO-OPERATION IN GLASGOW.

Though, taking the United Kingdom generally, efforts by the representative organizations to bring about satisfactory co-operative working arrangements between electrical contracting and municipal electric supply interests have been unsuccessful, a number of particular cases exist where practically complete harmony prevails.

We published a short time ago particulars of an arrangement which the contractors of Sheffield, England, were asked to adopt in conjunction with the Corporation Electricity Supply Department. All such attempts to settle matters are of importance, and are in some degree contributions toward the final settlement which must inevitably come before long, however these isolated efforts may individually fail. Since the Sheffield conditions were published, one more effort to bring about an agreement on disputed points between the contractors and electric supply associations has been unsuccessful. It seems not unlikely, however, that where others have failed, the Glasgow municipality may succeed.

Elsewhere in this issue the details are given of an arrangement which has been entered into in that city between the contractors and the municipal central station. While American conditions would not permit of an identical arrangement, the fact of such co-operation shows the growing sentiment for united effort in increasing the electrical business in Great Britain as well as in the United States.

The Glasgow arrangement forms a most important contribution toward the settlement of a chronic controversy. The prospects for any legislative measures, such as the electric supply association has been working for several years past, are extremely unpromising.

WHERE THE ELECTRIC MOTOR SCORES.

The benefits of the electric motor drive are constantly being emphasized in new ways. Recently a legislative committee in Massachusetts gave a hearing on proposed changes in the law governing the licensing of steam engineers and firemen, the discussion lasting for eight hours on a single day. Although the burden of the remarks addressed to the committee was not of immediate electrical interest, the evidence presented by manufacturers as to the difficulties created in many local power situations by the necessity of employing steam engineers to operate special steam-driven tools and machinery was impressive. It appeared that in a good many cases where a 10 or 15-horsepower motor would be adequate to perform a local service, the manufacturer depending upon steam power alone had to increase his operating costs by the employment of a licensed engineer, and great difficulties were encountered in obtaining engineers competent to run specialized tools like channelers in quarries, the paper-making industry also finding its costs increased by the licensing requirements.

Electrification of industrial plants was mentioned several times as a way out of the high cost of operation entailed by the necessity of placing licensed engineers in charge of certain steam-driven machines. It is clear that each industry and each establishment must be investigated on its own merits; this journal has no desire to see engineering problems of this character solved in an ex-parte fashion, but the simplification of the attendance problem effected by both the alternating-current and the direct-current motor deserves ample consideration as a factor in the satisfactory adjustment of power matters.

SEGREGATING ELECTRICAL CONTRACTS ON FEDERAL WORK.

In several states, the electrical contractors have made a move towards securing the segregation of the electrical work from other construction work in buildings erected by the state government, and this move has met with considerable success. A similar agitation in the case of the United States Government is equally desirable, as the conditions there are anything but favorable to the electrical contractor. Most contracts are now let in such a way that the bid for electrical work must be combined with the other construction in the given building, and there is no opportunity for electrical contractors to enter separate bids for this feature of the work. The advantages of independent bidding on this work have been so often discussed that it is not necessary to go into them now. It is probable that if these advantages were forcibly stated to the proper authorities a change might be inaugurated in the method of letting contracts for federal buildings. It certainly is in order for electrical contractors to make some effort in this direction, and it is for the purpose of such organized effort that they have a national organization.

Tenth Anniversary of the Technical Publicity Association.

A decade of successful life of the Technical Publicity Association was celebrated with a well attended banquet at the Hotel Martinique, New York, on Thursday evening, April 8. The annual business meeting was held at 6:00 o'clock, and was presided over by F. R. Davis, of the General Electric Company, president of the association. C. A. Hirschburg, of the Ingersoll-Rand Company, was secretary.

The following officers were elected for the ensuing year:

President, Arthur Haller, American Locomotive Company, New York City.

First vice-president, Elliot Reid, Westinghouse Lamp Company, New York City.

Second vice-president, W. B. MacLean, Otis Elevator Company, New York City.

Secretary, C. A. Hirschburg, Ingersoll-Rand Company, New York City.

Treasurer, H. M. Davis, Sprague Electric Works, New York City.

Executive Committee, F. R. Davis, J. J. O'Connell.

The banquet was held at 7:00 o'clock, with the retiring president, F. R. Davis, in the chair, and H. Tipper, of the Texas Company, and former president of the association, acting as toastmaster.

Three addresses were delivered as follows:

"Attitude of the Manufacturer Towards Advertising," by W. L. Saunders, chairman of the board, Ingersoll-Rand Company, New York City.

"A Decade of Developments in the Business Press," by Emerson P. Harris, president, Harris-Dibble Company, New York City.

"Ten Years of the T. P. A.," by F. R. Davis, General Electric Company, Schenectady, N. Y.

Mr. Saunders, in his entertaining address, commended highly the work of the Technical Publicity Association, and Mr. Harris in his address gave some interesting and valuable statistics respecting the amount of business done by the business press, and its present honorable and progressive position in the publishing world. Mr. Davis reviewed the work of the association year by year since its organization 10 years ago. Its history showed intelligent and earnest study of the field and a cordial effort on the part of the association to improve the relations between the advertiser, publisher and the agent and impressed every one present with the valuable practical results the association had accomplished and was still accomplishing in the many important branches of the advertising and publishing business.

The evening concluded with an entertaining program of a series of well rendered songs, which humorously endorsed the strong work of the retiring president and expressed hopes for his successor, and an amusing dialogue between W. C. Andrews, of the Edison Storage Battery Company, and the latest improved Edison phonograph concealed in the manly form of "Laughing Lew." Copies of the constitution of the Technical Publicity Association, as amended in February of the present year, were distributed to the guests.

Illuminating Engineering Society.

At a meeting of the Council of the Illuminating Engineering Society on April 8, various reports were submitted.

The Committee on Glare submitted two reports on the subject of "The Optical Properties of Diffusing Media." One gave a classification of diffusion, nomenclature and the physical theory of diffusion; the other dealt with instruments and methods for measuring diffusion and the theory of diffusion photometry. Both reports contain a wealth of valuable data and will be published shortly in the *Transactions* of the Society.

The Committee on Lighting Legislation reported that it had considered (1) a report containing material for formulating a code on factory lighting, which had been received from the Committee on Factory Lighting, and (2) a report submitted by the Committee on School Lighting containing material upon which it is proposed to base a code on school lighting. The function of the Committee on Lighting Legislation is to disseminate data and reports among legislative bodies, school boards, public service commissions and other bodies or individuals who may or should be interested in enactments, rules and regulations for better lighting.

The Committee on Reciprocal Relations with Other Societies reported that it is continuing its efforts to popularize the work of the Society among those organizations which are believed to be interested in the better illumination propaganda. For this purpose the Society has available for loan to lecturers slides and printed lectures on school lighting and some of the fundamental principles of illumination.

Wireless Telephone Success.

It is announced that through an invention by Irving Langmuir, of the Research Laboratory of the General Electric Company, Schenectady, N. Y., wireless telephony has been made practical for general use. Messages have been exchanged between Schenectady and Pittsfield, Mass., a distance of 50 miles.

Activities of Minnesota Jovians.

"Safety First" was the general subject for discussion at the meeting of the Minneapolis Jovian League in the Rogers Hotel April 9. A. W. Warnock, general passenger agent of the Twin City Lines, discussed the origin and growth of the movement in the United States and commented on the tremendous amount of good that has been accomplished by it, both in the saving of life and property. Mr. Warnock then outlined the work that has been done along this line in the Twin Cities and described the company's advertising campaign.

Mayor Wallace G. Nye told the Jovians of the interest the city has in this work and urged them to use their influence toward its promotion. Chief of Police Oscar Martinsen concluded the discussion with a description of the safety movement from the point of view of his department.

During the past week Minneapolis and St. Paul Jovians have been uniting their efforts with the electrical engineers of the University of Minnesota and members of the Minnesota Electrical Association in an effort to convince the Finance Committee of the Legislature of the need for an appropriation of $80,000 for a new electrical engineering building at the University. An appeal has been sent out to all the electrical men of the state asking them to use their influence with their representatives and senators to convince them of the need for the new building.

New York Jovian League.

The New York Jovian League held a very successful smoker and entertainment on Wednesday evening, April 14. Over 350 tickets were sold for the event. The affair was held at the Martinique Hotel.

The League meets every Wednesday noon, and is addressed by some prominent speaker. The attendance averages 175 to 200 and much enthusiasm is shown in the work. Frank E. Watts is chairman of the League and J. H. Betts is statesman for New York.

Institution of Electrical Engineers.

C. P. Sparks, a well known electric supply and mining electrical expert, is nominated to occupy the presidential chair of the Institution of Electrical Engineers when Sir John Snell's year of office comes to an end. The Council urged Sir John to continue for a second year, but reasons of health and pressing public duties have prevented.

Alexander Russell and R. T. Smith are nominated as new vice-presidents.

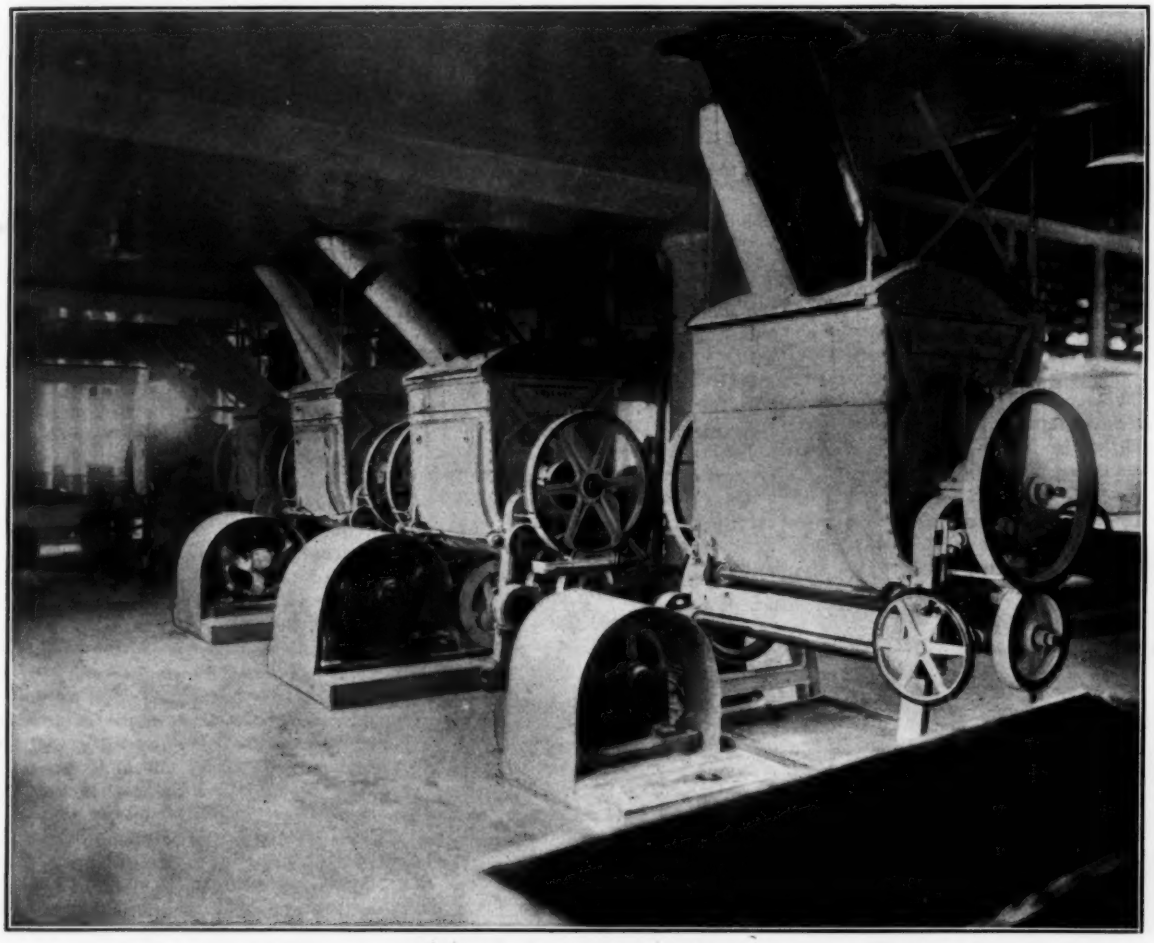
A new automatic telephone system has been placed in operation in Prince Albert, Sask.

Electricity in Bakeries.

This article points out the advantages of electric motor drive and central-station service for bakeries, giving data on the horsepower required by the various machines. An elaborate new establishment, recently completed in Chicago, is fully described and operating and motor data are given on six typical plants located in Washington, D. C.

There are so many advantages in favor of motor drive and central-station power for bakeries that it hardly seems possible that any baker could afford not to electrify his establishment, yet there are numerous plants where the now obsolete methods of operation still are employed. However, these will soon come to a realization of the merits and economies of electric operation and the function of the central-station salesman will then be to demonstrate the possibilities of electric baking.

Already in the few instances in which it has been tried, electric baking has proved much superior to any other method. The bread baked in electric ovens has a better color and will last much longer, as it is not dried out as it is in a brick oven. The bread is absolutely clean, which is almost impossible in a brick oven where the peel sends up a cloud of dust which alights on the fresh dough as it is being put into the oven.



Group of Motor-Driven Dough Mixers at the Schulze Baking Com pany Plant, Chicago.

In the electric bakery there are no dirty coal boxes to haul around and no labor to hire to do this class of work. It is not necessary to have men stay around on days when the ovens are not being used, to give them an occasional shovel of coal, so the ovens will be ready for use. The electric oven is ready to bake in 35 minutes after the current has been turned on.

In equipping a new bakery the saving in cost of the building is a big item. Electric ovens take up one-fifth the space of brick ovens and on account of their being light in weight ordinary mill construction is heavy enough. With brick ovens, which weigh several tons, it is necessary to provide the heaviest kind of building construction. Electric ovens are also much cooler to work by, as all of the heat is applied directly to the bread and is not wasted in the work rooms of the bakery.

Records are available showing a very satisfactory installation in a prominent bakery in Toronto, Can., which recently installed an electric oven of the Hughes Electric Heating Company type. This oven is proving more economical than the furnace-type oven which it replaced. Energy for the operation of the electric oven is supplied by the Toronto Hydro-Electric System.

In a recent comparative test the elec-

tric oven, the capacity of which is 180 loaves of 1.5 pounds, turned out 15 batches in 10 hours, or 2,700 loaves. The brick oven, the capacity of which was 450 loaves of 1.5 pounds, turned out five batches in 10 hours, or 2,250 loaves, 450 loaves less than the electric oven.

The floor space occupied by the brick oven was 256 square feet, while that of the electric oven is 32 square feet.

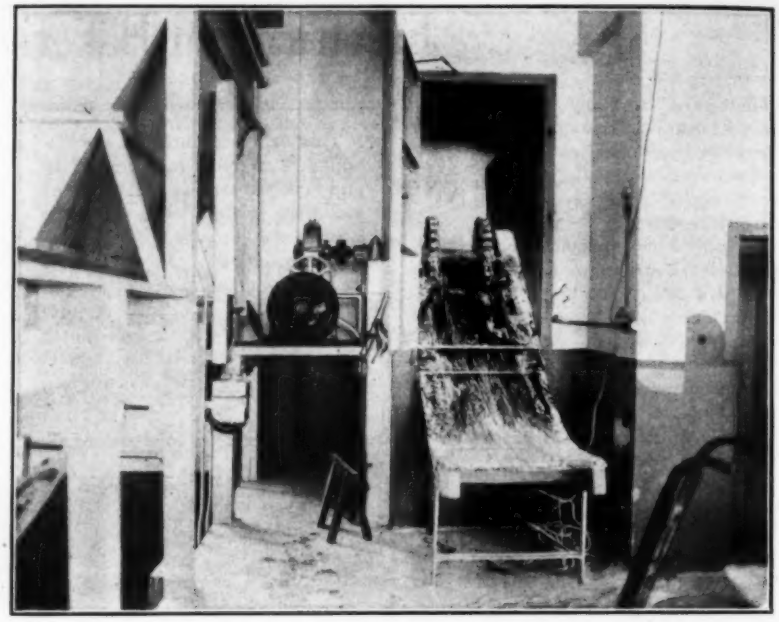
The fuel used by the brick oven was 0.25 ton of hard coal, which cost $2.00. The estimated fuel cost of 1,000 1.5-pound loaves of bread baked in the brick oven was 89 cents, although the fuel cost ran higher on several nights when there were only three or four batches put into the brick oven. The fuel cost for the electric oven would not be higher in case of the oven not being used regularly, as the cost stops when the current is turned off, and it takes only a few minutes to heat the oven after it has been standing idle.

The cost of electricity when used in the "off peak" period at Toronto, which is at night, is one-half cent per kilowatt-hour. The maximum current consumption of the electric oven was 26 kilowatt-hours and would cost 13 cents per hour when used continuously, or $1.30 for 10 hours' use. The total amount of bread turned out in 10 hours being 2,700 loaves, would make the fuel cost of 1,000 loaves 48 cents. This would show a saving in fuel over the brick oven of 41 cents per 1,000 loaves.

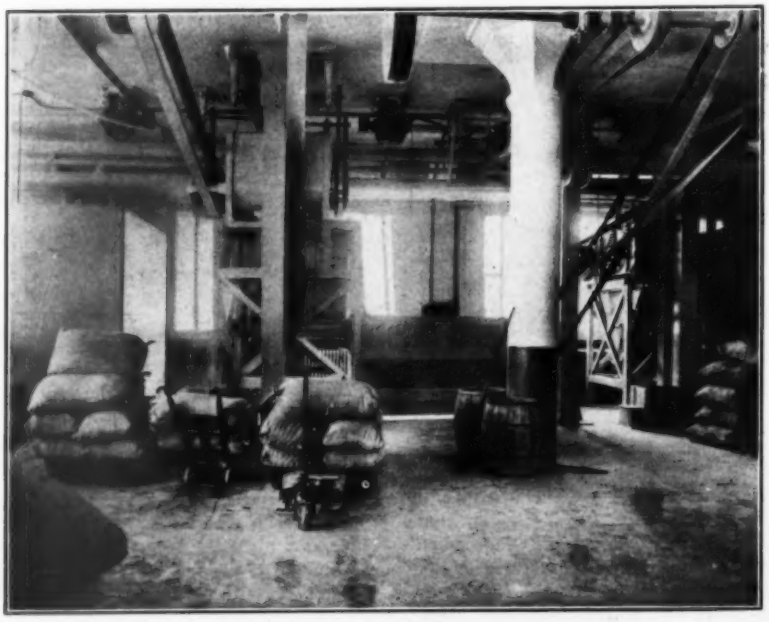
The labor cost was less than that of the brick oven on account of the increased amount of work turned out with the continuous baking. The saving in labor for 1,000 loaves was estimated at 22 cents per 1,000 loaves and would have been much greater if the capacity of the electric oven had been the same as that of the brick oven.

In case the bread weighed less than 1.5 pounds, the output would be greater and the amount of fuel used would be less, as the oven would not run on full heat all the time.

Taking everything into consideration, the cost of electricity at 1.5 to 2 cents per kilowatt-hour, would equal coal at $8.00 per ton, and electricity at 3 to 4 cents would equal gas at $1.00 per 1,000 cubic feet, taking into consideration the quality of gas and the efficiency of the gas ovens used. Further particulars of this installation are given in our issue of March 13, 1915.



Elevator for Sacks of Flour, Driven by 10-Horsepower Motor at Schulze Bakery.

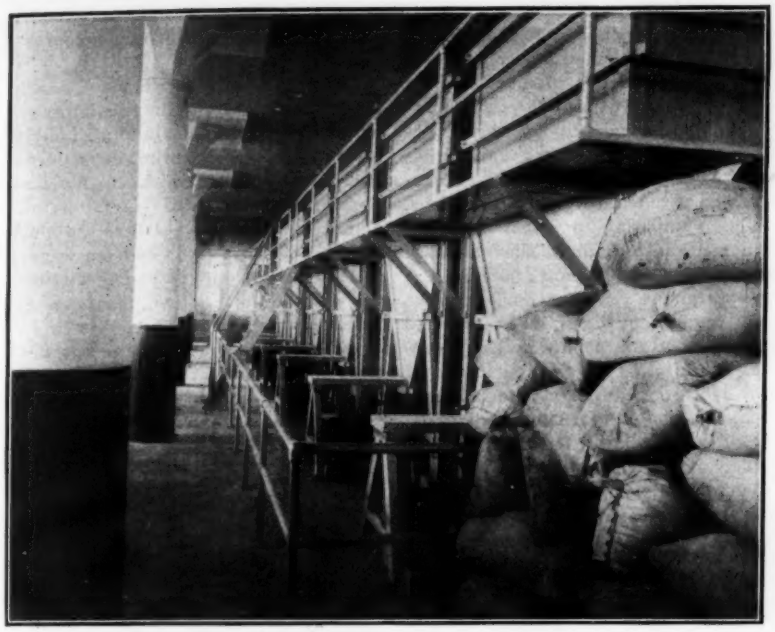


Two 10-Horsepower Motors Driving Blending and Cleaning Machines at Schulze Bakery.

In this country several installations have been made and there is an enormous field for additional business. With the rates for energy being continually lowered bakers will find the electric method most economical of all methods, everything being taken into consideration.

As to electric motor drive, the most important advantage is cleanliness. Present-day conditions make it necessary for every baker to maintain a high standard of cleanliness in his plant and it is difficult to see how this condition can be obtained where overhead belting and shafts are depended upon to transmit energy. A clean, sanitary plant is recognized as one of the greatest assets for the bakery and this is practically impossible without electric light and power.

Reliability of power supply is also of extreme importance in bakeries and numerous plants have been converted to central-station service on this one argument alone. With an isolated plant, even one that is efficient and well managed, operating difficulties are certain to arise that will cause costly delays and even without these, the continual operation is dependent entirely upon the reliability and resourcefulness of the engineer and firemen. Sometimes duplicate equipment or emergency units are installed for use in case of accident to the regular plant but this practice increases the investment and fixed charges to such an extent that it is almost prohibitive. The reliability



Group of Flour Bins With Motor-Driven Screw Conveyors Below.

of central-station power is so well known that no reference need be made to it here.

Another important advantage of motor drive in connection with central-station power is the uniform speed which is attained by the driven machines. Uniformity of quality is of extreme importance to the baker, for upon this and uniformity in baking depends the success of the establishment. Uniformity can only be secured by mechanical means, necessitating the use of motor-driven machinery. Exactly the same operations must be carried on for each batch of dough, and it is this requirement that makes the motor-driven dough mixer, especially, of such importance.

The freedom with which the electric motor can be used as an independent drive for a single machine or group of machines, as compared with other methods, and its ability to operate under unfavorable conditions is a great advantage in bakeries. In many instances the advantage of having a separate drive for dough mixers alone justifies the use of electric motors in bakeries.

Practically all of the machines used in bakeries run at slow speed, so slow in fact, that any motors that might economically be used for driving them require considerable speed reduction. In arranging the drives for a bakery, therefore, this feature should be borne in mind in order that the individual drive shall not be carried too far, although many of the manufacturers of bakery machinery supply their equipment as complete motor-driven units with the proper gear ratios carefully figured to give the required speed.

Alternating-current motors of the polyphase induction type admirably meet the conditions of bakery-machine drive. The operating characteristics of direct-current motors also permit of their use with entire satisfaction except that commutator trouble has been experienced in many instances due to flour and dough forming on the commutator and of course resulting in considerable sparking and trouble. Inclosed motors can be used but these of course reduce the motor capacity and call for greater care and attention in operating. Suspending motors from the ceiling or mounting them on raised platforms eliminates this trouble considerably but makes necessary belt drive in cases where gear connection would perhaps be preferable.

The polyphase induction motor, on the other hand, can be used without inclosing, and will operate satisfactorily even after the windings and all parts of the machine have become covered with the caked flour and dough. However, where belt driving is to be employed it is advisable to raise the motors out of the range of flying particles, where this can be done without sacrificing flexibility or light.

As regards sizes of motors necessary to drive the machines found in the bakery the accompanying data are given. It should be noted that dough mixers require a comparatively large starting torque, and for that reason motors operating them should have sufficient overload capacity.

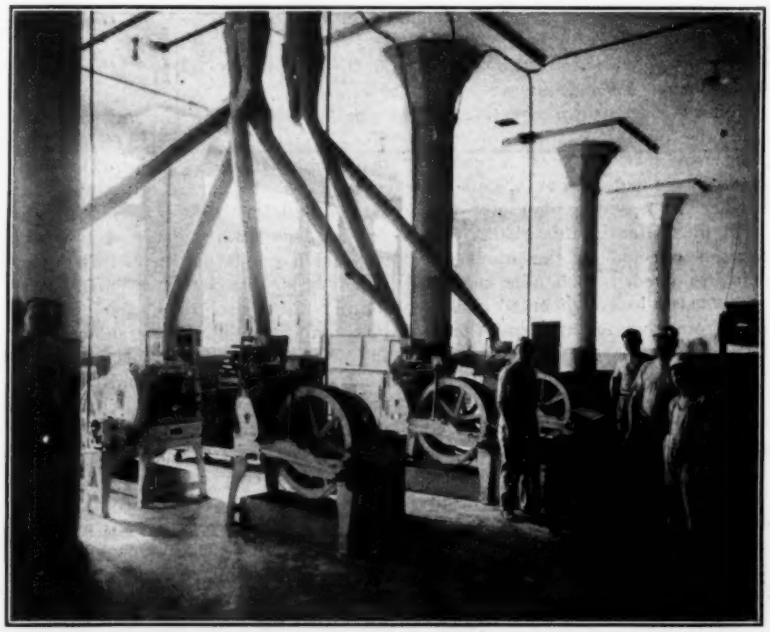
Dough-mixing machines range in size from one to six-barrel capacity.

DAY DOUGH MIXERS.

No. of Machine	Capacity Barrels	Horsepower
1	1	2
2	2.5	3
3	3	4
4	4	4
5	5	7.5
6	6	10

These sizes are for single speed on which the mixer arm of the machine makes 14 revolutions per minute. For very stiff dough the horsepower of the motor should be increased 25 per cent.

Combination machines used by small bakers consisting of flour sifter and elevator, dough mixer and cake machine, require a motor sufficiently large to drive the dough mixer, this



Dough Dividing and Molding Machines at Schulze Bakery.

governing the horsepower required. Most of these combination machines are supplied as motor-driven units, however.

HORSEPOWER REQUIRED BY MISCELLANEOUS MACHINES.

Machine	Horsepower
Molding machine (capacity 2,000 loaves per hour)	2
Dividing machine (capacity 2,000 loaves per hour)	2
Dough breaker	5
8-shelf reel oven	5
Meal mill	7.5
Pan elevator	1
Tray elevator	1
Conveyor	1
Flour sifter	1
Ovens	0.5
Blender	2
Packing table	0.5
Read reversible mixer	5

The processes involved in baking in the typical plant can best be described by referring to the new bakery of the Schulze Baking Company in Chicago, unquestionably one of the most complete and attractive installations in existence. The accompanying illustrations show a few of the more important motor applications in this $600,000 establishment. Electric power is used throughout except for heating the mammoth ovens, but motor-driven mixing machines are used in connection with the natural-gas system employed. The economy of motor drive is well illustrated in this plant by the reduction effected in the number of employees needed to handle the output of 140,000 loaves of bread per day. Aside from this feature, and the excellence of the product, made possible largely by reason of the uniform speed of the machines, the most striking feature of the plant is its cleanliness, emphasizing another strong advantage of electric drive.

The interior walls are all of white-enameled brick, the floors of smooth concrete and most of the machines, motors and equipment are painted white. A feature of the installation is the ventilating system which provides for washing all air before it is delivered to the various rooms. In summer the air is cooled and in winter heated and distributed under pressure so that the tendency of unwashed air to enter around windows, etc., is overcome. In the mixing and rising departments the temperature and humidity are kept absolutely constant, regardless of outside weather conditions.

The ventilating and air washing equipment is located in the basement and is completely motor driven. A 7.5-horsepower motor operating at 1,120 revolutions per minute is belted direct to a Sirocco blower which supplies the air to the various ducts after passing through a Gordon air washer supplied by a Buffalo centrifugal pump, direct-connected to a 7.5-horsepower motor running at a speed of 1,600 revolutions per minute. A two-horsepower motor drives an air compressor for the humidifier-control system and a five-horsepower motor operates an exhaust fan used in removing foul air.

In an adjoining room in the basement is located a Frick refrigerating machine which cools the air in summer, cools the entire drinking-water supply and furnishes refrigeration for several departments of the plant where perishable goods are kept. This machine is driven by a 75-horsepower motor, 735 revolutions per minute, belt connected. A 15-horsepower motor drives the brine circulating pump used in connection with this machine and two five-horsepower motors drive two water pumps used for circulating water throughout the building.

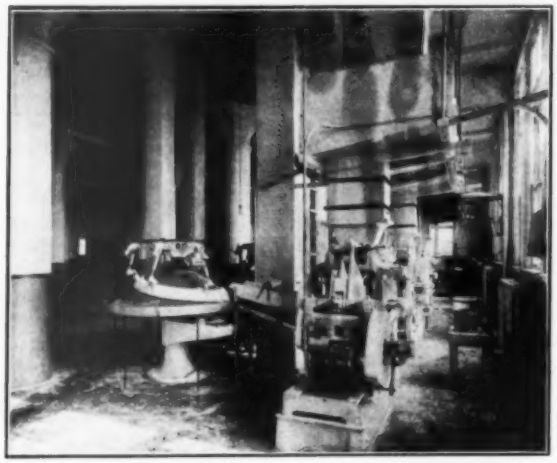
As a further provision for insuring absolute cleanliness and minimum amount of dust, every floor is provided with vacuum cleaning connections, this system being used for cleaning flour and dust from all crevices about the machines and building. A five-horsepower motor, running at a speed of 720 revolutions per minute, is belted direct to a 4.5 by 4.5-inch air compressor for this service.

Throughout the entire plant advantage was taken of the flexibility of motor-driven machines and all individual machines and entire departments have been arranged so as to facilitate the rapid sequence of operations and eliminate handling of the product. Flour in sacks is received from wagons and trucks at the receiving platform and allowed to slide to the basement storage room. From here a sack elevator raises the flour to the top floor where the bins are located. A 10-horsepower motor running at 1,120 revolutions per minute is geared direct to this elevator, the method of connection being shown in one of the accompanying illustrations.

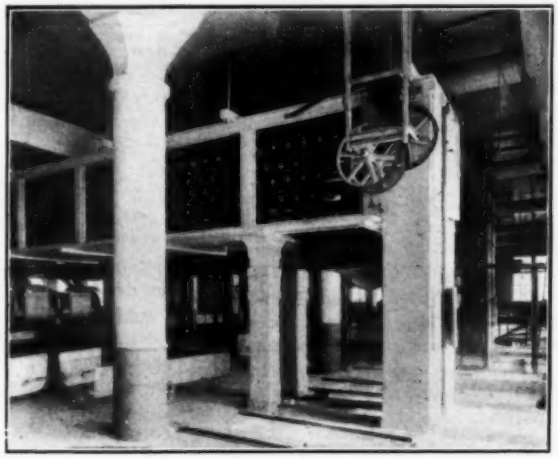
The flour falls by gravity into cleaning machines where it passes through revolving screens of silk. From these the flour passes to the blending machines, there being two of these, each driven by a 10-horsepower motor. One of the accompanying illustrations shows the battery of bins where the flour is next taken. These bins are each provided with a screw conveyor driven by a two-horsepower motor, running at a speed of 1,120 revolutions per minute. From the latter bins the flour is taken when required, to the automatic scales. Water is also automatically weighed and the mixture falls by gravity into the dough mixers located on the floor below.

At present there are six dough mixers, two of six-barrel capacity, two of five-barrel capacity and two of four-barrel capacity. Each are individually driven by motor geared to the machine. There are two 30-horsepower motors, two 20-horsepower motors, and two 15-horsepower motors used for driving these machines.

After being thoroughly mixed the



Group of Motor-Driven Rounding Machines at Schulze Bakery.



One Section of Proofing Machine—Motor-Driven.

Bakery Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for twenty-four hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

The Havenner Baking Company, Washington, D. C. Individual belted drive throughout. Running hours per week, 55.

Total connected horsepower, 68.5. Total number of motors installed, 9. Average kilowatt-hours per month, 2,018.2.

Kilowatt-hours, per month, for nine months:

June, 2,205.4; July, 1,909.9; August, 1,971.2; September, 2,031.4; October, 2,026.2; November, 2,027.6; December, 1,857.4; January, 2,142.7; February, 1,992.0.

Load-factor, 5.4 per cent; operating-time load-factor, 13 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are direct-current motors operating at 220 volts.

Number	Horsepower	Application
1	25	For emergency. This motor is held in readiness in case of accident.
1	1	Pump.
1	20	Dough mixer.
1	20	Dough mixer.
1	5	Mixer, blender and sifter.
1	7.5	Freight elevator.
1	5	Dough roller.
1	5	Dough roller.
1	5	Dividing machine.

Stohlman's Bakery, Washington, D. C. Individual belted drive throughout. Running hours, per week, 150.

Total connected horsepower, 38.5. Total number of motors installed, 9. Average kilowatt-hours per month, 1,102.0.

Kilowatt-hours, per month, for nine months:

June, 987; July, 1,017; August, 1,200; September, 1,096; October, 1,131; November, 1,207; December, 1,044; January, 1,152; February, 1,084.

Load-factor, 5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are single-phase, 60 cycles, alternating-current, operating at 220 volts.

Number	Horsepower	Speed R. P. M.	Application
1	4	1,120	Roller.
1	2	1,420	Scaling machine.
1	2	1,120	Molder.
1	10	900	Dough mixer.
1	5	1,120	Dough mixer.
1	4	1,120	Pump, sifter, blender.
1	2	1,120	Dough mixer (small), crumb machine.
1	7.5	900	Freight elevator.
1	7.5	900	Ice-cream freezer, ice breaker.

J. G. Meinberg's Bakery, Washington, D. C. Individual belted drive throughout. Running hours per week, 144.

Total connected horsepower, 33. Total number of motors installed, 6. Average kilowatt-hours per month, 1,021.3.

Kilowatt-hours, per month, for nine months:

June, 984; July, 1,211; August, 1,169; September, 1,198; October, 957; November, 904; December, 959; January 888; February, 922.

Load-factor, 6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are single-phase, 60 cycles, alternating-current, operating at 220 volts.

Number	Horsepower	Speed R. P. M.	Application
1	2	1,120	Dough mixer, egg beater, egg and cake machine, crumb machine (small).
1	3	1,120	Ice chopper, 40-quart freezer.
1	5	1,120	Dough roller.
1	3	1,600	Sifter, flour blender, flour elevator and small pump.
1	10	1,120	Dough mixer.
1	10	1,120	Dough mixer.

Bakery Data—Sheet No. 2.

The Charles Schneider Baking Company, Washington, D. C. Individual belted drive throughout. Running hours per week, 157.

Total connected horsepower, 64.5. Total number of motors installed, 9. Average kilowatt-hours per month, 1,811.1.

Kilowatt-hours, per month, for nine months:

June, 1,850; July, 1,740; August, 1,780; September, 1,760; October, 1,850; November, 1,830; December, 1800; January, 1,970; February, 1,820.

Load-factor, 5.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are direct-current motors, operating at 220 volts.

Number	Horsepower	Application
1	10	Dough roller.
1	2	Cake mixer; crumb machine; and ceiling fan.
1	10	Dough mixer.
1	10	Dough mixer.
1	10	Dough mixer.
1	5	Dough roller.
1	7.5	Freight elevator.
1	5	Egg beater; cake mixer.
1	5	Blender: and sifter, elevator.

Holmes & Son Bakery, Washington, D. C. Individual belted drive throughout. Running hours per week, 156.

Total connected horsepower, 73.75. Total number of motors installed, 18. Average kilowatt-hours per month, 4,786.7.

Kilowatt-hours, per month, for eight months:

July, 5,270; August, 5,224; September, 5,165; October, 4,927; November, 4,508; December, 4,326; January, 4,702; February, 4,172.

Load-factor, 11.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are direct-current motors, operating at 220 volts. (This does not include two 30-ampere and two 45-ampere charging plugs for vehicle batteries.)

Number	Horsepower	Application
1	2	Conveyor for 14-foot and 9-foot ovens.
1	2	Mixer and sifter (pie).
1	0.25	Rimmer.
1	0.75	Crust roller.
1	1	Rimmer.
1	15	Freight elevator.
1	1	Blender (8 barrel).
1	2	Pie-plate washer.
1	6	Strainer, chopper, beater.
1	0.25	Apple peeler.
1	2	Polishing head.
1	10	Freight elevator.
1	10	Dough divider, baller.
1	10	Dough mixer, blender, elevator.
1	2	Molder.
1	3.5	Cake mixer.
1	1	Cake mixer.
1	5	Ice machine.

The Boston Baking Company, Washington, D. C. Individual belted drive throughout. Running hours per week, 144.

Total connected horsepower, 55.3 (approximate). Total number of motors installed, 9. Average kilowatt-hours per month, 3,146.9.

Kilowatt-hours, per month, for nine months:

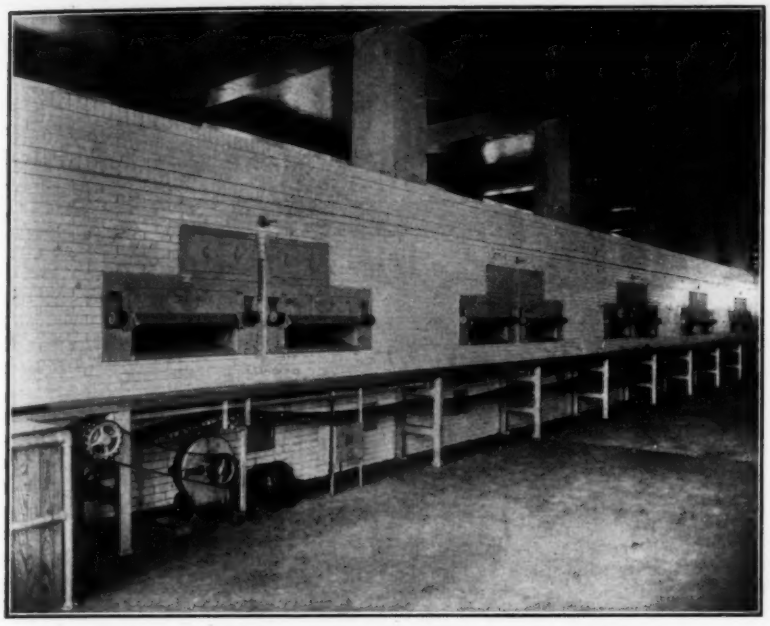
June, 2.835.8; July, 2,877.8; August, 2,866.6; September, 2,978.8; October, 2,549.4; November, 2,477.2; December, 3,991.2; January, 3,839.6; February, 3,904.6.

Load-factor, 10.4 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. (One 7.5-horsepower motor for break-down service not included.) All motors are direct-current motors, operating at 220 volts.

Number	Horsepower	Application
1	10	Dough molder, two loaf molders, dough divider, dough roller.
1	0.5	Pan cleaner.
1	4.8 ampere	Pump.
1	4.8 ampere	Cake mixer.
1	10	Dough mixer.
1	15	Dough mixer.
1	3	Flour feeder and pump, sifter and blender.
1	45 ampere	Elevator.
1	1	Pump.



Motor-Driven Bread Conveyor in Oven Room, Schulze Bakery.

dough is dumped into troughs and allowed to rise. It then is fed by gravity into the dividing machines on the floor below, which cut the dough into pieces of the proper weight. There are four Werner & Pfleiderber dividing machines, each gear driven by a three-horsepower motor, operating at 1,120 revolutions per minute.

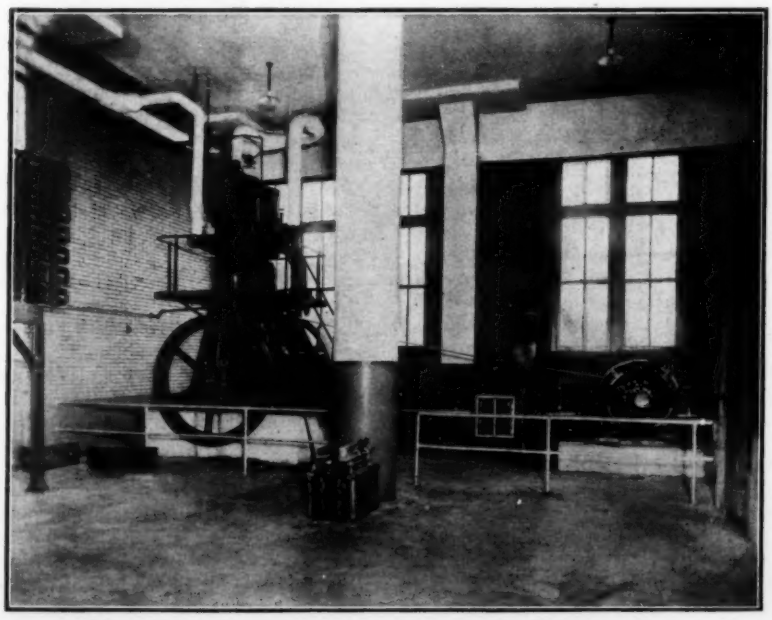
From the dividers the dough goes to the rounding-up machines where it is worked. There are four of these machines, each gear driven by a three-horsepower motor, running at a speed of 1,120 revolutions per minute. Next the dough is placed in individual canvas buckets and carried back and forth in a conveyor until it has regained the lightness worked out in the previous processes. This operation is called proofing. There are two such proofing machines, each equipped with 900 buckets and each driven by two two-horsepower motors.

There are eight Thomson molding machines, each driven by a two-horsepower motor, 1,710 revolutions per minute, which receive the dough from the proofers and mold it into shape. The formed loaf is then conveyed to the ovens.

The baking room at the Schulze Baking Company plant is one of its most attractive features. Here, as in other sections of the building, the interior finish is white-enameled brick, and the cleanliness of the room is most impressive. The ovens are arranged in two long rows, facing a central aisle. Motor-driven conveyors are run along each row on which the baked bread is conveyed to the wrapping machines. There are four three-horsepower motors used for operating these conveyors, each motor running at a speed of 1,120 revolutions per minute.

The ovens are heated by natural gas, supplied from a pipe line. Two gas pumps, driven by 7.5 horsepower motors, are used in connection with this system. The gas connections to each oven are made in such manner that the pipes can be instantly removed and the ovens heated by coke or wood when necessary.

With the present equipment installed at the Schulze plant the daily output is 140,000 loaves of bread. Provision has been made to install additional machinery when this becomes necessary and with the reserve capacity for a completed future equipment the plant will be capable of producing a total of 400,000 loaves of bread per day.



Frick Refrigerating Machine Driven by a 75-Horsepower Motor.

Dayton Company Encourages Suggestions from Employees.

At the March meeting of the heads of the various departments of the Dayton Power & Light Company, it was decided to install suggestion boxes at convenient locations throughout the offices and plants, and offer a prize of $5.00 each month to the employee making the best adopted suggestion, and to encourage suggestions from all employees the company intends to pay 50 cents for each suggestion adopted. By this method the company thought that each employee would take a more active interest in the activities of the company, studying, not only the needs of his own individual work, but also everything that relates directly or indirectly to the good of the company.

Municipality Advised to Purchase Power.

The town counsel of Easthampton, Mass., has reported his findings on a proposal that the municipality undertake the lighting of its streets and public buildings. His opinion is that the town cannot legally go into the street lighting business except as it purchases the existing lighting plant and undertakes a commercial business.

A proposal is favored that the town accept a proposition of the lighting company to operate its pumping station, now electrically driven by an isolated plant. There is a question as to the legal propriety of the town operating this plant.

Commercial Practice
Management, Rates, New Business

Successful Appliance Campaign at Columbus.

The new-business department of the Columbus (O.) Railway, Power & Light Company is conducting a 30-day special selling campaign, in which premiums are offered as follows. An ironing board is given away with each electric iron sold; an electric iron or choice of electric percolator or electric toaster, with each electric cleaner; an iron or ironing board, or percolator, or toaster, with each electric washing machine; an iron, or toaster, or percolator, with each house-wiring contract. By arrangement with dealers in electric appliances throughout the city, the sale is made co-operative, the premiums being given out, no matter where the purchase is made.

The campaign was launched by half-page display advertisements in the newspapers, in which the company stated, "We know that you don't know that electric appliances are the cheapest, are the most convenient, are the most labor-saving. Therefore, buy one of the appliances listed below, and we will give you an extra appliance free. Their use will prove the truth of the above statement, while the savings made will soon pay for the appliance you buy."

After a two weeks' test, W. A. Wolls, manager of the new-business department, is ready to pronounce the campaign a decided success, and he is thinking of continuing it beyond the 30-day limit.

It is a significant fact that since the Columbus company began its progressive policy along new-business lines, about two years ago, through the use of advertising and special campaigns, its business has shown a constant upward tendency.

New Business at Louisville.

The commercial department of the Louisville Gas & Electric Company during the week ending March 27 secured contracts for 153 electric customers with 84 kilowatts lighting load and 61 horsepower in motors and took orders for wiring 22 already-built houses. The Ford Motor Company, which is erecting a new assembly plant in Louisville at a cost of $500,000, will have a 150-horsepower motor and 50-kilowatts lighting load.

What Advertising Has Done for the Denver Company.

The luncheon given in honor of the Denver Ad Club by the Denver Gas & Electric Light Company, on March 30, in the Assembly Hall of the Gas & Electric Building, marked an epoch in the history of electricity in Denver, for it was the first large public luncheon to be cooked entirely by electricity. Electric percolators, toasters, etc., are in common use in private homes, but this was the first time that the modern electric appliances for cooking were put to a practical test on such a scale.

An elaborate menu was prepared by Mrs. Alice Williams, demonstrator for the company, who was ably assisted by twelve of the young ladies employed in the company office. Over 700 feet of cable was installed under the supervision of R. G. Gentry, assistant commercial manager for the company, and connected with the 110 electrical appliances used.

Following the luncheon Frank W. Frueauff, of Henry L. Doherty & Company, New York, spoke to the Club on "How Advertising Helps Market Gas and Electric Products."

Mr. Frueauff is an enthusiastic advertising man and he pointed out to the members of the club what advertising had done for the Denver Company and other Doherty concerns. Following are some interesting excerpts from his speech:

"In 1900 the Denver Gas & Electric Company was a relatively small concern, the ideas of the management at that time being along the lines of most gas and electric companies, i. e., if people wanted gas and electricity they knew where the office was and could get it by waiting a reasonable length of time after putting in their orders. At that time a new man came to Denver—Mr. Doherty, and he put some of his ideas into the organization which have been worked on and enlarged from time to time, and to him is primarily due credit for the development of the gas and electric industry in Denver and for many of the ideas that are in common use now by central stations all over the country. He was a firm believer in advertising. He had done in a modest way some successful things by advertising in other places, and he felt it was more than necessary in Denver.

"During the year 1900 the Denver company was confronted by serious competition. Some people financially able had secured a franchise and started in to give the public private and commercial lighting and there was competition that meant either rule or ruin for one of the two enterprises. We felt that we were more or less in disrepute being the operating company and not having done as many things as we might have. We were more or less on the defensive, but when we got into advertising that sentiment gradually changed, and the success today is due to the work commenced in 1900.

"We started out with a modest amount of newspaper advertising and a modest force of men to talk to the people about new uses for gas and electricity. In 1900 the Denver Gas & Electric Company had 4,500 electric users and today there are over 36,000. Of course, part of that growth is due to the growth in population, but we had to go out and talk to a lot of people who had moved into the outskirts, and used oil lamps because they thought electricity was not economical. In short we had to create a demand and that has been done largely by talking to the people through the newspapers, through circulars, follow-up letter campaigns, and most of all, more consistently, possibly, than any other way, through the visits of the representatives who have rung the door bells, ofttimes meeting with rebuffs, but eventually making friends among customers and those are the people who have boosted the income and business of the company.

"In 1904 we had built our business along satisfactorily lines. Our first efforts were directed towards getting gas ranges and water heaters into use and after that there was still a big field for electricity. We had some serious difficulty getting the electric sign into popular use. The first signs were not particularly ornamental, some of them were badly hung and for a time there was agitation about taking them down. Mr. Doherty wrote a letter to Mayor Speer in 1904 and he then made the prediction that if reasonable regulations for the erection of signs could be made, Denver would become as famous as "The City of Lights," as other cities are for their parks or boulevards, and we believe in a way that has been carried out. That bad feel-

ing at the outset may have been a backset but it taught us some of the problems which have since been solved. Another field we have developed largely by advertising was the use of the electric motor. There is hardly an industry or business in town today that does not find some use for electricity other than lighting. In 1901 there was only 1,100 horsepower connected, today we have 22,849 horsepower in motors connected.

"Today we are doing in a way, some pioneering with the electric vehicle. To my mind it is only a question of a few short years before the electric vehicle will be the accepted means of conveyance the country over. You hear today of this objection and that criticism but we have passed through those difficulties in our establishing the use of motors for every purpose, and it will only be a short time when this vehicle will be accepted as the best means of city transportation.

"When the Welcome arch was put up on the streets of Denver we went through another of those trying experiences that are rather discouraging. There was considerable discussion as to whether it was a desirable thing or not. I believe by the constant discussion that was had, the wave of public sentiment swung toward more ornamental street lighting and out of the modest beginning and that simple arch, has come what are today the well lighted streets of Denver, which are boasted of by a good many people outside of our organization.

"In 1900 the company had quarters in a little one-story building opposite the Brown Palace Hotel. If it had not been for advertising it would not have been necessary for the company to put a second story on that building and then to have outgrown those quarters and have come to Fifteenth and Champa Street to get more room.

"I have not the figures before me, but our income per consumer in spite of the lower rates now is higher than any other town in the United States. That is due to advertising. The matter of rates has had something to do with it. We have attempted to keep our rates so that no matter what demand we have created with the consumer he could still afford to pay for our service. In 1900 electricity was 18 cents per kilowatt-hour, while today it is eight cents. At that time the company had 248 employees on its payroll, today we have 1,000, and when construction work is being done as many as 1,200. All that has been done by talking our product and advertising.

"The advertising experience and success in securing business by talking to our customers or prospective customers, I think is the foundation of the growth of the Doherty organization throughout the country. If it had not been possible for us to have created a demand and progress faster than the normal growth of the community, there would have been little or no reason for our attempting to branch out in other cities and build up as we have here."

City Pumping Plant Saves by Electrical Operation.

The economy of motor drive for pumping town water is shown in the case of the town of Canton, Mass., where a little more than a year ago electric service was substituted for steam. During 1914 the cost of service was $1,100 less than that of the year before, while the income from the sale of water increased materially.

An electric time switch is installed at the pumping station, which automatically starts and stops the pumps, which operate periodically day or night, keeping the standpipe full at all times. The cost of attendance is almost nil under the modern arrangement.

By the use of Venturi meters the water pumped is accurately measured. Formerly, the quantity of water pumped was computed from the number of strokes of the steam pump.

Movement for Better Store Lighting in Cincinnati.

The Cincinnati Association of Display Men is preparing for a joint session with the Retail Merchants' Association, principally for the purpose of devising plans for better store illumination in the downtown districts. The display men propose to demonstrate to the retailers, by means of lectures and the showing of various types of efficient electric window and store units, the ease and economy with which first-class illumination can be had, and its value in attracting business, and it is hoped that the use of electric lighting for display purposes may be considerably stimulated.

Rockford "Made Electrically" Exposition.

In our last issue mention was made of a "Made in Rockford Electrically" show held recently under the auspices of the Rockford (Ill.) Electric Company. All manufacturers using central-station service were invited to exhibit a sample of their product in the display rooms of the company and all prospective power users were invited to inspect the exhibits. Much interest was shown, not only by the manufacturers but by the public in general and many inquiries regarding service were received during the display.

Two Views of the "Made In Rockford Electrically" Exposition Held in Company Display Room.

The accompanying illustrations show sections of the display. There were 75 individual exhibitors and the different products shown totaled several hundred in number.

Slogan Sign for Hopkinsville.

The city's slogan, "Greater Hopkinsville Wants You," has been erected in two-foot letters by the Kentucky Public Service Company on Campbell Street, 25 feet above the street level, and that company is now supplying the service to operate the sign.

Electrical Construction

Record Forms for the Electrical Contractor.

Of the keeping of records, as of the making of books, there is no end, except the end in sight, the object of the system of records. Whether they are kept by electrical contractors or by the proprietor of the corner grocery store, they ought to show the man who keeps them "where he is at." Records which will do this are not hard to devise to suit any business, but the trouble with many of them is that they represent a vast amount of bookkeeping, a multiplicity of laborious entries. Some of them mean more trouble than actaul performance of the work they record.

What the contractor who makes his business work for him wants to know is whether his business is making money for him, and if not, why not; if so, why so? He wants to ascertain this at the least expenditure of time and effort. He wants a concise and thorough record of what goes into every job. This is what the Harry I. Wood Company, of Louisville, Ky., gets by means of a system of records and reports it has been making use of for several years. It is a system which fits a condition which is by no means unique.

Contractors may be divided into two general classes, consisting of those who are contractors pure and simple, and whose stocks of materials and supplies are maintained solely for use in filling contracts, and of those whose contract department is part of the whole business and whose stocks of materials and supplies are for sale, either at wholesale or retail. The first class has, of course, the simplest requirements in the way of record-keeping, whereas the second not only has to keep tab on what the contract department is doing, but must preserve the relations between this branch of his business and the whole. If it is a case, when getting out stuff for a job, merely of going to the bin, selecting what is needed and entering it as "taken out," a simple form of record is needed.

The means by which such records may be kept for either class of contractors can be illustrated by forms which have been used by the Harry I. Wood Company. The simpler form was first employed. The other, which takes into consideration the fact that the company is a jobbing house, was evolved out of the necessity of keeping a record of the transactions between the contracting department and the jobbing department and at the same time keeping a record of everything supplied for each job. Both may be subject to improvement—the men in the Wood establishment do not claim perfection where these forms are concerned.

Consider the plan for use by the contractor of the first class. One advantage is that the same form will serve in making out the estimate, as well as in keeping actual record of performance. The Wood Company no longer uses it, but found it serviceable for some time. It is a ruled sheet, shown in Fig. 1.

In the first column are entered the quantity of the articles described in the second, which gives space enough for a ledger entry. Under "Taken Out" are three columns, in the first of which the cost of the total number of described articles is entered for assistance of the man figuring the job. The second column under "Taken Out" is reserved for entries which are made as the material described is taken from the stock room, ordinarily corresponding to the entry in the first column on the left. A third column under "Taken Out" contains space for entries, which are made in red ink, for all material taken out in excess of that noted in the estimate. Under "Returned," credit, of course, is given, and the total cost is figured from the sum or difference of the previous entries and entered accordingly.

Job No..... **RECAPITULATION.** Contract { NO / YES

OUT	DESCRIPTION	Taken Out		TOTAL	Returned	USED	Cost of B. P.		

Fig. 1.—Contractors' Record Form.

The entries in a record sheet of this character read entirely across from left to right, and there is thus a check on every item involved on every job. The estimator can see by a glance at the various entries in red ink when he was under the amount of material required, and this is the most important item of all, perhaps. Comparison of the totals in the "Used" column with those in the "Out" column at the left will show him in a moment where he was over and where he was under the quantities called for in actual performance of the contract. Under the entries for materials used there is generally room enough on the several sheets, or on the one sheet, for any number of entries as to time and sundries, so that this part of the costs of any job is not difficult to record. The sum total represents not only the account from which the itemized bill can be figured, but it constitutes a permanent record if such is desired, and is a comparison between the estimated cost and actual cost of the job.

The other form (Fig. 2), somewhat more elaborate, meets the requirements of the Wood Company, although Ferdinand F. Valinoti, superintendent of the contracting department and devisor of the system, has an idea that he will be able to improve upon it in some respects. An advantage of the second form is that it constitutes practically a complete record of any job, and as a loose-leaf ledger sheet it is easily kept and preserved. Labeled "Work Record," it is all that and an index to the material taken out. Furthermore, though it does not give a check against every item, the total serves for comparison with the total on the estimating sheet and where discrepancies occur their nature can be readily ascertained. The whole system is based on the department plan and the necessity of giving the general bookkeeper a means of keeping a general record and at the same time keeping the line distinctly drawn between the contracting department and the store department.

The ruled portion of the record is divided into three sections, one devoted to materials, one to labor and one to sundries. Under the heading of material the division is double, for the rea-

son that the entries as to material issued usually outnumber those for labor and sundries.

All deliveries from the store department to the contracting department are by requisition. Blanks for this purpose, all serially numbered, are kept in book form, in duplicate and perforated. When the contracting department wants, for instance, a bundle of conduit tubing, the order is made out, being recorded, with the job numbers, by carbon on the duplicate underneath; the form is detached and presented to the storekeeper, who issues the material, filing the order. At stated times the bookkeeper in the contracting department goes through the order book and transfers the entries from the duplicates of the orders he finds there to the Work Record. Date, material and amount to be charged to the contracting department are noted here, as well as a description of the material.

The spaces on the Work Record correspond and the date, the serial number of the order and the amount in dollars and cents is duly noted. Frequently more material is taken out than required, and some has to be returned to the storekeeper. For this purpose he has a credit book, similar in form, etc., to the order book in the contracting department. On receipt of material in good condition he makes a note on the credit blank, and that is returned to the contracting department. He thus retains a day book, from which he keeps his own records. After they are posted in the contracting department's Work Record in red ink, these credit slips go to the general bookkeeper's desk. The order slips take a similar course, and both are entered in the general book, the entry showing the serial number in the proper column. This serves to distinguish the entries from entries representing sales by the store department, credit and charge alike, and has proved thoroughly satisfactory.

The labor division has space for the date, the name, a square in which to indicate whether the employee is an electrician or helper, and the total charge for labor. The sundries section contains space for a description of the charge, car fare, "c. f."; railroad fare, "r. r. f."; drayage, "dryg.", etc., and the columns for the amount. This constitutes the Work Record, with 30 lines in the ruled section, this having been found sufficient for all average cases. If the job happens to be intricate and to extend over a considerable period, it is a simple matter to run over to another page and slip a second or a third, or as many sheets as needed into the Work Record book, carrying the totals forward. Sometimes the Work Record is not posted for a week at a time and labor entries are made by the week.

These labor entries come off a special pay-roll report (Fig. 3), which is made out from week to week, from post-card reports made every day by the men on the jobs. Every man, electrician or helper, keeps his own time and carries a supply of stamped post cards with space on them for reports on four different jobs. These contain the date, description and number of the job, and he notes the number of hours put in and the outlay for carfare. Also, and this is important, there is a space for signature of the person, or representative of the person for whom the work is being done. This is that person's O. K. for the claim for labor. If the workman is a member of a gang with a foreman, the foreman also signs the card. From day to day these report cards are posted into the pay-roll report book or file, from which, in turn, the labor and sundries entries on the Work Record are taken.

Here is a system of records which gives an interesting account of the progress on every contract. It is easily possible to keep all of them for an indefinite length of time and to classify them, according to job, to department, to electrician, helper, etc. If the man who made the estimate went astray, a glance at the Work Record will show him. If the discrepancy between the estimated cost or contract price and the total costs does not give a sufficient allowance for overhead, profit, etc., the estimate maker can see where he was wrong on every item except materials, and reference to the file of the order and credit slips will show him in what particulars he went astray. The record is concise, simple, and there is not a laborious amount of bookkeeping to be done.

WORK RECORD

Contract Price $_____ _____ 191... No._____
Address Customer's Name
Address Charge to
Nature of Work

Permit No. Inspection Notice No. Certificate No.

MATERIAL								LABOR					SUNDRIES	
Date	No.	Charge	Credit	Date	No.	Charge	Credit	Date	Name	E	H	Amount	Items	Amount

Fig. 2.—Job Record Form Used by Harry I. Wood Company.

WEEKLY PAY-ROLL REPORT ENDING

*Name*_____ *Date*_____

*Rate*_____ *Per Day* *Total Amt. $*_____

	REG.	EXTRA	Car Fare	
SATURDAY				
MONDAY				

Fig. 3.—Workman's Time Record.

Kansas City Contractors Participate in Electric Show.

At an electric show arranged by the Kansas City Electric Light Company, Kansas City, Mo., a large number of electrical contractors of the city participated and displayed devices of various kinds. A shopping list, in the form of a neat little booklet, was given as a souvenir to every visitor stating that his or her residence was not already wired. On the last page of this booklet was the following statement, under the heading "Business Ethics":

The members of the Kansas City Electrical Contractors' Association consider themselves as being engaged in a business in which there is a well defined duty and obligation toward the public and themselves. The business demands that members use every honorable means to uphold the dignity and honor of this vocation, to exalt its standards, and to extend its spirit of usefulness. The result is service with safety.

Although the show was in progress but one week many direct sales were made by the exhibitors.

Contractors and Central Station Co-operate at Glasgow.

The city of Glasgow, Scotland, was for years regarded as a model for other places to copy in respect of the control of its public electricity undertakings, and it may be that what it now decides will carry a far-reaching influence. It is announced that the Glasgow Branch of the Scottish Electrical Contractors' Association has arrived at an agreement with the City Electricity Committee, which only awaits the Corporation's approval, respecting the hiring-out of cooking utensils, heating apparatus and other utensils. Terms have been agreed upon as to the establishment of a central showroom in the city with the following objects: (*a*) to provide facilities for present and prospective users of electrical energy; (*b*) to exhibit a selection of the latest electrical appliances in one place instead of having to visit numerous places scattered over the city; (*c*) to promote the use of electrical appliances for lighting, heating, cooking, etc; (*d*) to educate the public with regard to the possibilities of these appliances.

The electrical contractors have agreed that the proposed showroom shall be equipped and managed entirely by the Corporation for five years from the date of the opening of same on the following lines:

The showroom shall exist primarily for the exhibition of electrical appliances. Contractors and their customers shall be afforded all possible facilities for inspecting the stock of appliances kept in the central showroom. Any electrical contractor who shall request the Corporation to sell from the stock in the central showroom any fittings, accessories, lamps or apparatus shall be entitled to receive out of the apparatus price one-half the discount which he would have received from the makers had the contractor sold such apparatus to his customer directly. All fittings, accessories, lamps and apparatus sold from the showroom shall be at list prices, such list prices to be the usual current list prices of the firm supplying goods to the showroom. As far as possible sales initiated in the showroom shall be completed through the contractor who directed or sent the customer to the showroom. All wiring work resulting from the inquiries at the showroom shall be done by the contractor and no undue preference shall be shown to any one or more electrical contractors. Hiring of apparatus shall not be undertaken from the showroom, but the showroom management shall be free to lend apparatus for a short period to possible customers under exceptional circumstances and make a charge if they think fit for the loan of such apparatus. All charges made to customers by the showroom management shall be separately stated on the relative demand notes sent to the customers and all sums paid to and obtained by the Corporation as a result of business done in the showroom shall be separately shown in the annual accounts of the Corporation Electricity Department, which accounts are audited by an independent auditor.

Installation of Fire-Alarms Compulsory in Massachusetts Factories.

The Committee on Labor of the Massachusetts Legislature has reported favorably on a law to compel the installation of fire-alarm signal apparatus in every factory over two stories high, and in which more than 25 persons are employed.

Among the Contractors.

John McPrice, electrical contractor and dealer in electrical material, Pittsburgh, Pa., announces the removal of his office from the Empire Building, to 1228 Fulton Building.

The contract for the complete electrical equipment of a 42-apartment building at Nineteenth Street and First Avenue South, Minneapolis, Minn., has been secured by the Beck Electrical Construction Company, of Minneapolis.

John J. Duck recently opened a second electrical store at 432 St. Clair Street, Toledo, Ohio. Mr. Duck started in the electrical business in 1892 and in 1902 opened an electric shop on St. Clair Street. The new store has been especially arranged to appeal to ladies who do electrical shopping. All sorts of devices including everything from electric washing machines to electric toys are to be found at this store.

F. A. Clegg & Company, of Louisville, Ky., have recently been awarded two good contracts, one for wiring the new building of the Kurfees Paint Company, which is in course of construction at Brook and Market Streets. This is a $2,200 job, which will include a few small motors for operation of paint-grinding machinery. The building is to be a five-story and basement reinforced-concrete, fireproof construction. The other contract is for wiring the new Bernheim building, a fireproof, brick, concrete and steel building for retail stores, an $1,800 job. This is to be a five-story structure and will have stores on all five floors with a central corridor on which the upper stores will front, with provisions for show windows to be lighted as are those on the streets.

New Wiring Regulations for Boston Garages.

New regulations for the construction of automobile garages in the metropolitan fire district of Boston and suburbs went into effect April 1. They provide that no lighting system other than electric shall be installed, and the wiring for lights, battery charging and electrical equipment shall be installed in a manner equal to National Electrical Code requirements, with the following regulations:

All cutouts, outlet and junction boxes, switches, receptacles, connectors or other live metal parts, motors, dynamos, and apparatus capable of emitting a spark must be placed four feet above the floor or outside the garage. Apparatus capable of emitting a spark must be provided with a brass wire screen of No. 14 mesh or finer over openings exposing sparks. Flexible cords must be reinforced for rough usage. The live end must have an approved plug connector so constructed that it will break apart readily at any position of the cord, and the opposite end, if terminating in a connector, must be the projecting part and protected against accidental contact.

Flexible cables for battery charging must be of approved theater-stage type and have connectors of at least 50 amperes capacity and constructed like the above. All portable lamps must be equipped with keyless sockets attached to approved portable lamp guards with handles and hooks.

All new wiring in garages except cords and cables specified above, and those for pendent lamps, must be installed in metal conduit or armored cable, but metal moldings may be used in offices and show rooms.

Steel for Magnets.

The small electrical manufacturers and others have at times tried to produce cheap permanent magnets for instruments of sufficient initial strength and lasting qualities. To produce such magnets the material *must* be kept within the following limits, as regards chemical composition:

	Minimum Per cent.	Maximum Per cent.
Carbon	0.60	0.70
Manganese	0.20	0.40
Silicon		0.15
Sulphur		0.05
Phosphorus		0.05
Tungsten	4.00	6.00

The magnets should be hardened, magnetized, and aged before testing. While aging, magnets should be placed so that adjacent poles are of like polarity and separated by an air space of about one inch.

H. E. Weightman.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, President, 59 Deerfield Avenue, Hartford, Conn.
H. S. WYNKOOP, Vice-President, Municipal Building, New York, N. Y.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, City Hall Annex, Boston, Mass.

Executive Committee
EUGENE N. DAVIS, Chairman, Brookline, Mass.

SECTION REPRESENTATIVES:
C. H. Fletcher, H. Burnes, British Columbia.
A. W. Hopkins, G. W. Perry, Western New England.
Washington Devereux, A. H. Lilley, Philadelphia.
E. N. Davis, H. A. Knight, Eastern Massachusetts.
C. A. Hannan, O. E. Smith, New York City.
C. W. Mitchell, John W. Carrell, California.

MEMBERS AT LARGE:
George L. Collison, Frank R. Daniel, James H. Fenton, F. G. Hartwell, J. E. Latta, James B. McCarthy, Thomas D. MacColl, A. A. Moffitt, R. P. Strong

"LET THE CODE DECIDE."

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Secretary's Message.

In view of the very full report of the convention which has already appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, as well as of the remarkably correct report of the meetings of the Electrical Committee, National Fire Protection Association, held on the following days, the Secretary finds it necessary to mention only a few matters here.

There are still outstanding dues from members at large, 33 in all out of a total of about 80, and the Secretary particularly requests them to forward these dues, which are those for the year which closed April 1, at once or inform him if they no longer wish to be affiliated with the Association; also to remind them that the dues for the *current* year are now payable (and have already been paid by 75 per cent of the membership).

During the period covered by this report 75 questions have been sent out to the Executive Committee of 25 members. Of these nine members have answered every question; two over three-quarters; five over half of them; and the remaining nine members less than half; four of the nine, however, are Section members appointed late in the period and their replies have been well kept up since they began work, the other five are members-at-large who answered less than ten each.

President Wynkoop requests me to remind the members of the Executive Committee that this question work is the most important of their duties and one which should be carefully and conscientiously attended to, and that in case of Section members each is expected to reply in full and individually unless the replies are the result of joint consideration and discussion, when both should sign. Entirely individual replies are, however, expected except in special cases for special reasons.

I give below those parts of the convention proceedings which could not be placed in the telegraphic report but which the executive officers wish to have on formal record.

President's Address.[1]

Gentlemen: It is again my privilege to welcome you as your president to your biennial convention. I am not unmindful of the work of preparation of the special committee in relation to these sessions. Vice-president Wynkoop has advised me of some of the plans for our banquet this evening and I can assure to you a most enjoyable and profitable evening. Mr. Braddell, of the special committee, has been untiring in his planning for our pleasure and his associates, as well as himself, will convince you of the success of their efforts this evening. For this splendid meeting place and the anticipated pleasure of the banquet and following post-prandial addresses I feel personally obligated to the committee and take this method and time for expressing my gratitude.

In returning to you the commission which you placed in my hands four years ago, which commission was repeated when you re-elected me as your president two years since, I do so with regret. I have greatly enjoyed being your president, I have been surrounded with a cabinet of officers that has been considerate of me. At no time have I been conscious of any serious disagreements concerning my suggestions and judgments.

During the past two years a plan I have long cherished was consummated—that of having an association which would be truly national in its scope and local in its application and influence. To accomplish this much study was necessary and today we have, in addition to our membership at large, six well organized sections, the management of which rests entirely with the members of the sections themselves. I predict that our section plan will increase and that the results to us all will be beneficial and proportionate to the increase. Today I close ten years of office holding, in various capacities, a term I do not regret, and now feel it to be proper to close my official career with a few suggestions to be referred to a suitable committee.

New Sections.—It is impossible both from an economic and a physical point of view for a great number of our members to attend the sessions of our Association, our membership extending from the Atlantic to the Pacific and from the valley of the Saskatchewan to the Mexican line. That our work toward an universal interpretation of the National Electrical Code and in aiding our membership toward a clearer understanding of our standard should continue, your president feels that we should make a further effort toward creating new Sections. It has been my privilege to attend meetings of the two Sections in New England, and I am somewhat familiar with the work of the New York Section, and I am well convinced that the interchange of experience among the individual members of these Sections has been of benefit to all those attending the meetings. There is considerable work involved in creating a Section, more work than should be required of your Executive Committee or officers and I would suggest that this opportunity for further advancement in extending the work of the Association receive your careful study and that a special committee be authorized whose work shall be to endeavor to interest members and others to organize Sections where they do not now exist.

Foreign Members.—Your Secretary has advised me that he has received several inquiries concerning membership in our Association from inspectors residing in foreign countries; he has been obliged to reply that there was no provision made for such membership in our constitution.

One of the purposes of our Association is to acquire knowledge through the experience of others and it has seemed to your president that it would be a wise

[1] By retiring President T. H. Day at the morning session of the biennial convention, National Association of Electrical Inspectors, Hotel Martinique, New York, March 23, 1915.

step to make some provision for membership of inspectors in foreign countries, with special dues to meet the increased cost of mailing, etc., that we might secure for our home membership the experience of inspectors in foreign fields. With members in European countries at this time we might be able to secure, through such information as they might give us gained from experience in their territories, that knowledge of the concentric form of wiring which we are absolutely without at present.

I would suggest that your incoming executive officers give this matter the consideration it requires, and that you invest such officers with authority to submit to the Executive Committee suggestions for legislation on this subject.

Official Organ.—The relations between the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN and the Association continue to be congenial and cordial. In the arrangement I have felt that the members were the gainers. We should not lose sight of what we are receiving and as individual members we should transmit such questions as arise in our work to the Secretary that he may have sufficient copy, and not have him feel that we are not keeping our part of the agreement. *If every member in attendance at this session would give the Secretary at least one question today he would have sufficient material to last him for a year!* May I ask that you do your part.

In relation to the meetings of the Sections may I venture to suggest that in preparing the program for a meeting, provision be made for the reading of a paper, preferably by a member, and that a copy of such paper with any necessary sketches, together with a transcript of the meeting be sent to our Secretary, that he may prepare it for our Department in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN and thus disseminate the knowledge gained by the members of a Section to all of our membership and the electrical fraternity as well. We cannot be benefited ourselves without those with whom we come in contact in our work being equally benefited should they be given the opportunity of reading what we have heard.

This will also assist our Secretary and make unnecessary the preparation of an article that he may have adequate copy. I would most respectfully urge a careful consideration of this matter by the several Sections.

Insurance Congress.—Doubtless you are aware the management of the Panama Exposition at San Francisco has organized a most complete Insurance Congress, to which a number of associations were invited to send accredited delegates. We were indeed fortunate in having an interested and able member of the Association on the Pacific Coast who was willing to serve as our delegate and I accordingly appointed Mr. C. W. Mitchell of the California Section, as such, and such matters as may be of interest to our members I feel confident he will transmit to you through our Secretary. Mr. Mitchell has shown commendable interest in our Section plan and the thanks of the Association are due him for his work as our delegate at the Insurance Congress. I recommend that the Association confirm his appointment to extend throughout the life of the Congress.

National Fire Protection Association.—In 1905 Representative James E. Cole, then president, secured recognition for our Association by the Electrical Committee. Mr. Cole was then elected our representative on that committee and has continued as such to the present time. He is too well known to you all to require any words of commendation by me. We have been well represented by him. Our Association is now a member of the National Fire Protection Association, which membership gives us the right to be represented on the Electrical Committee of that Association. I would ask you to empower the Secretary-Treasurer to continue that membership.

Conclusion.—I would suggest that this address be placed in the hands of a committee of three, and that such committee report concerning the several matters contained therein at the afternoon session.

I cannot refrain from thanking you gentlemen who have come to our sessions and hope that you go away much benefited. The success of the past term is not entirely due to your retiring president; many members have contributed to the success. The Secretary will no doubt acquaint you with the statistical matter of our progress. I wish his figures, especially those of the financial side of his work, might make possible a nominal salary for his office. We could not pay him for the work he has done, but it seems to me a way should be found by the Executive Committee to give him some recognition for faithful services rendered. The correspondence of his office is voluminous and to him I am greatly indebted and heartily thank him for what he has willingly done.

Gentlemen, I thank you for your attention and now ask what disposal will you make of your President's Message?

It was moved and seconded that the address of President Day be referred to a committee consisting of three members: J. B. McCarthy, of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN; C. A. Hannan, secretary of the New York Section; W. L. Smith, general secretary.

This committee met and at the afternoon session brought in the following report:

The Committee on the President's Address beg leave to report: In reviewing the biennial address of the retiring president, we are impressed with the evidence of earnestness, loyalty and devotion given to his work, and the amount of time spent in the service of this Association, time which the estimation in which he is held by his superiors in his regular business shows must have been found largely in hours which might legitimately have been given to recreation and the enjoyment of the home relations. It challenges our admiration and we trust and believe his arduous labors may be amply repaid by increased interest in our work among the members, by larger enthusiasm and by success in every Section.

We heartily approve the suggestion that a special committee be appointed upon Section Organization, believing that the development of the Section idea is vital to the increase in effectiveness of our Association.

We further approve of the recommendation regarding recognizing a class of foreign members, but we suggest that instead of being referred to a special committee it be turned over to a Committee on the Constitution to be appointed by the president.

We view with satisfaction the conditions of cordial relationship with our official organ and suggest that the thanks of the Association be formally tendered to its official staff, and we especially recommend the serious and thoughtful perusal of this section of the address to every one of our members.

We recommend that the suggestion regarding the Insurance Congress be adopted.

We recommend that no action be taken regarding the membership in the National Fire Protection Association, that matter being sufficiently cared for by a vote of this Association passed in 1911 and still in force.

With regard to the suggestion that a way be found to pay the Secretary a small salary, we recommend that no action be taken but that he be empowered as in the past six years to employ reasonable clerical assistance for such special occasions as may be necessary.

In conclusion we congratulate the Association on the success that has attended President Day's administration during the past two years.

His untiring energy, unbounded enthusiasm and devotion to the interests of the Association will not be forgotten and must inspire increased interest and effort in its future usefulness and prosperity. We recommend the address and this report be spread upon the records.

(Signed) C. A. Hannan,
J. B. McCarthy,
W. L. Smith.

Upon motion made by O. E. Smith, of New York, and seconded by H. A. Knight, of Worcester, this report was accepted and its recommendations adopted.

At the evening meeting, it was unanimously voted by a rising vote that the National Fire Protection Association be petitioned to arrange for the retention of Ex-Representative Cole upon the Electrical Committee, and accordingly the following Preamble and Resolutions were drawn up and adopted.

WHEREAS, at the Biennial Meeting of the National Association of Electrical Inspectors, held at the Hotel Martinique, in the City of New York, on the twenty-third day of March, at which over one hundred members were in attendance, the members learned that the Representative of the Association on the Electrical Committee of the National Fire Protection Association, Commissioner James E. Cole, of the Wire Department of the City of Boston, Mass., and twice a president of this Association, had asked to be released from the office he had so long held, and

Whereas the members were also advised that the Executive Officers had long known of Commissioner Cole's desire and that their efforts had failed to persuade him to change his decision, and

Whereas his long and wide experience as a member of the Electrical Committee, his calm and careful judgment, his gracious personality, his reputation as a man and as one well versed in electrical matters, together with his wide circle of acquaintances among the Electrical and Fire Protection Interests, pre-eminently fit him for the position he has so long filled and from which he now requests to be relieved by his confreres in the Association and

Whereas the members while feeling a profound regret because of his request and the failure of the Executive Officers to obtain his consent to a re-election, feel that their sense of honor and friendship requires that they must yield to his wishes, but also that professional duty has obligations as well.

Therefore be it Resolved that in view

of Commissioner Cole's long experience and other exceptional qualifications as indicated in the preamble, the members of the National Association of Electrical Inspectors would most respectfully request and urge that if possible the Executive Officers of the National Fire Protection Association arrange to retain Commissioner Cole upon the Electrical Committee, in order that his experience and wisdom may not be entirely lost to the Electrical, Fire Protection and Public Interest as expressed in the future development of the National Electrical Code, and be it further

Resolved that copies of this Preamble and accompanying Resolution be presented to Mr. Franklin H. Wentworth, secretary of the National Fire Protection Association and to Mr. Ralph Sweetland, secretary of the Electrical Committee of said Association.

The Secretary desires to say for the information of those members who were not present, that Commissioner Cole has been the only occupant of this office since the Association has been represented on the Committee. The Executive Committee learned in December of Commissioner Cole's desire to be relieved and while they made every effort to persuade him to change his mind, they realized that his reasons were excellent and indeed in a way unanswerable. While this was so, however, they were not such as to prevent his continuing on the Committee in some other capacity than as Representative of this Association.

In selecting another gentleman then for our Representative, after a careful consideration of the possible field of choice and a most preposterous amount of correspondence, the Executive Officers unanimously settled upon Mr. R. P. Strong, of New Orleans. Mr. Strong has long been a member of our Executive Committee, he has replied to every question sent out for this department since the present Secretary took office four years ago and his replies have been distinguished by the correctness of the decision given and by the lucidity of the accompanying reasoning, when such seemed necessary.

He was also already a member of the Electrical Committee and therefore conversant with its procedure. The members of the Association are to be congratulated heartily that Mr. Strong consented to act as our Representative.

The Secretary hoped at this time to be able to announce President Wynkoop's selections for Executive Committee members at large, but the list is not yet complete; neither has the consent of all the appointees been obtained, so that it must go over.

It is possible, however, to announce that J. C. Forsythe, chief inspector, Electrical Department, New York Board of Fire Underwriters, has been appointed Chairman of the Executive Committee, and that J. E. Latta, of the Underwriters' Laboratories, and J. B. McCarthy, of the ELECTRICAL REVIEW AND WESTERN ELECTRICAN, have been reappointed.

President Wynkoop has appointed a Committee on Section Organization consisting of Thomas H. Day, chairman; James E. Cole, of Boston; and R. J. Forsyth, of Greenfield, secretary.

Also a Committee on Constitution and By-laws, consisting of W. Lincoln Smith, chairman; and J. C. Forsyth and Alfred E. Braddell, of New York.

There will be certain other committees appointed later.

The Secretary desires to call the attention of the members *especially* to Ex-President Day's remarks under "Official Organ" in his address. Possibly the members may be tired of the Secretary's persistence, but he is emphatically the one who suffers in this case. Let me urge again that the members and the Sections send in material regularly and promptly. I want not only questions but *field incidents*—dozens of them were mentioned at the convention which came to my hearing in various ways, each of which would have made an interesting, helpful and valuable paragraph for publication in this department.

The Secretary has sometimes heard that some think there is "too much Secretary in these columns" but if so it is not by his desire. Nothing would please him better than to transcribe matter simply, instead of having to originate because of dearth of material or because only *ten* out of an Executive Committee of *twenty-five* have troubled to reply to his question bulletin.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Santa Maria Gas and Power Company was authorized to issue $25,000 of first-mortgage six-per-cent bonds; $20,000 to be used in discharging notes and the remainder for additions and betterments to its property.

CONNECTICUT.

The Third Annual Report, for the year ending June 30, 1914, has recently been issued in bound form. The schedules of rates, in effect June 30, 1914, are given for electric, gas and water companies operating in Connecticut. The report also includes statements of the financial conditions of all public service companies, and a brief summary in tabulated form of the Commission's orders and decisions during the period covered.

DISTRICT OF COLUMBIA.

Terminal Taxicab Company. Pursuant to the provision of the Public Utilities Law requiring the Commission to value the property of all public utilities within the District, the Commission has made a valuation of the properties of the Terminal Taxicab Company and of the Washington and Maryland Railway Company.

In the decision rendered April 2, 1915, fixing the value of the Taxicab property, the Commission says: "This Commission is of the opinion that a utility is entitled to earn the whole cost of rendering the service and in addition thereto a reasonable return on the fair value of the property actually used and useful for the convenience of the public.

The utility claimed certain organization and pre-organization expenses which, in part, consisted of discount on preferred stock. The decision says: "The utility contends that the discount on the stock should be capitalized (1) because a generally recognized element in the cost of financing a new enterprise, and (2) upon the authority of the Wisconsin Commission. It does not appear that discount on stock is a cost of financing a new enterprise. A stock certificate is merely the evidence of ownership of a share in the property, profits, and risks of a corporation. Bond discount differs from stock discount in that bond discount is an adjustment of interest on a debt. The case before the Wisconsin Commission quoted by counsel for the utility in support of his contention is a case involving bond discount and not stock discount. The Interstate Commerce Commission is very specific upon the method of handling discounts on capital stock and has so expressed itself in the classification of accounts prescribed for electric railways effective July 1, 1914, page 75." * * *

"The effect of these rules is to exclude discount on capital stock from any consideration as property and to

set it aside in an account which shall be amortized by assessments upon stockholders or from the return on the property. These rules are entirely consistent with sound principles, and the accounting principles prescribed by the Interstate Commerce Commission are required by the organic act of this Commission to be followed where practicable."

The utility claimed an allowance for "going value" equal to the estimated amount by which the profits of the utility had fallen short of a return of 15 per cent on the investment. An investigation of the company's balance sheets showed an average return of 11.25 per cent on investment, as shown on the company's books, or 18.5 per cent on the amount paid in on the capital stock. "But even if it is assumed that the utility has not received a reasonable return on the investment up to date, the Commission is of the opinion that this deficiency should not be capitalized. In fixing reasonable rates to be charged by this utility for service the Commission will consider the claim made by the utility that it is entitled to a reasonable return from the beginning of its operations."

In regard to a claim for "good will" the Commission says: "Whatever value 'good will' may have in the purchase of a business, it is not an element upon which the public should pay a return, and, therefore, not a thing to capitalize in a rate-making valuation. Such a capitalization would have the inconsistent result of charging customers higher rates because of their very patronage."

After arriving at a fair value of the property, an order is entered requiring the company to conform its depreciation account to the following rates of depreciation, based on the cost of the property new: For buildings and electrical equipment of buildings, 3 per cent; for motor cabs, 21.5 per cent, and for office furniture and fixtures, machine shop equipment, tire-room equipment, and miscellaneous equipment, 7 per cent.

Washington and Maryland Railway Company. In determining the cost of reproduction new of the property of the Washington and Maryland Railway Company, the Commission allowed 15 per cent for contractor's profit, figured on the cost of material and labor, or only on the cost of labor, influenced by the manner in which the work of construction was actually done. The Commission also held that, in determining the cost of reproduction new there should be added the following percentages: For utility's engineering and superintendence, 5 per cent; for interest during construction, 3 per cent, and for legal, organization, insurance, omissions, and contingencies, 3 per cent. "Since these values depreciate with the property, the 11 per cent should be figured on the depreciated value in determining the cost of reproduction new less depreciation.

"The work of construction would be completed within one year. It is assumed that funds would be borrowed only as needed, and hence that interest would be paid on only half the amount for the time of construction, or half of the rate on the full amount. Interest at 6 per cent, therefore, amounts to 3 per cent figured on the total amount for the full year."

The company is ordered to conform its depreciation account to rates of depreciation, based on the cost of property new, of 3.34 per cent for way and structure, and 4.25 per cent for power-plant equipment.

INDIANA.

Indeterminate Permit. An amendment to the public utilities law, which was approved March 8, eliminates that part of Section 18 of the 1913 law, which provided that "every executive and general officer" of each company must be a *bonda fide* resident and citizen of Indiana. This amendment also extends the time within which a public utility may surrender its franchise granted by any city, town or municipality from July 1, 1915, as the old law provided, to July 1, 1917.

New Laws Affecting Municipal Utilities. A bill, approved March 9, provides that all municipal corporations of this state which own or operate electric light, power or water plants shall be authorized, upon procuring the consent of the public service commission, to furnish either electrical current, or water, or both, to any person, firm or corporations, either municipal or private, living or situated without the corporate limits of the municipal corporation owning or operating such plants.

Another bill approved March 8, permits any city in the state owning and operating an electric lighting and power plant, which has from the earnings of such plant accumulated a surplus after having set aside a sufficient amount for the depreciation and after setting aside a sinking fund for the payment of bonds that have been issued, to transfer any such surplus to its general fund, providing that the city shall first report to the public service commission the amount of its earnings, current expenses, the sum set apart for depreciation, the amount of its bonds outstanding, and the amount set apart as a sinking fund for the payment of such bonds.

KANSAS.

Senator J. L. Bristow was appointed to take the place on the Commission vacated by James A. Cable, April 1, 1915. The Commission has been reorganized and Senator Bristow will act as chairman and will handle the transportation cases which come before the Commission; John M. Kinkel will handle telephone complaints; and C. F. Foley, former chairman of the Commission, will handle municipal utilities and private utilities such as electric utilities and waterworks.

The Sabetha Mutual Telephone Company was authorized to establish a new schedule of rates. The present rates are $1.00 a month for all classes. The company may now charge $2.00 a month for business phones, $1.25 for residences and $1.00 for four-party lines. It is understood that the increase is necessary to save the company from a deficit.

Fort Scott, Kans. The Commission issued an order, March 31, recommending that the city of Ft. Scott pass an ordinance restoring rates for electricity which were in effect prior to the rates fixed by the present ordinance. This ordinance, passed in August, 1914, reduced rates about 30 per cent and the Commission finds that the present rates are unreasonable.

The Kansas Commission has only appellate jurisdiction over electric rates of local utilities, and if the council does not pass the ordinance suggested, the Commission may bring suit to compel such action.

The Commission also ruled that the city had no authority to fix rates for gas.

NEW YORK—First District.

Col. William Hayward has been appointed to succeed Commissioner Maltbie, whose term of office expired February 1, 1915. Colonel Hayward has acted as counsel for the Thompson Committee which conducted the recent investigation of the two state commissions. He took up his official duties on the first day of April. His term will expire on February 1, 1920. Mr. Maltbie is the last member of the original Hughes Commission and was appointed to take office July 1, 1907.

NEW YORK—Second District.

The Westchester Lighting Company cases have apparently reached a final settlement before the Commission. Stipulations have been filed by the company and the complaining communities accepting the order of the Commission, issued December 22, 1914. (Reported in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, January 2, 1915.) The application for the rehearing of the original cases, recently argued before the Commission, is withdrawn by both the company and the complainants. The company agrees to make the rate reduction in the order effective on May 1. Only minor changes in the order have been made, chief of which

is the permission to the company to maintain its present minimum rate at one dollar a month for electricity, as it was argued that no testimony was adduced on the question of a minimum electric rate.

The maximum rate for electricity is to be lowered to 12 cents per kilowatt-hour throughout the territory complaining, and the same reduction is to apply to the newly complaining territory in Mount Vernon and New Rochelle.

The company not only agrees to comply with the Commission's order for electric rates, but it has further agreed with the complainants' counsel in the Port Chester, Tarrytown and White Plains cases, to reduce its rates for illuminating gas in compliance with the general recommendations in the Commission's opinion.

The new electric rate is to remain in force for a period of at least three years, and during that period the agreement for annual gas-rate reductions will result in a flat maximum rate of $1.25 per thousand cubic feet in these villages.

New York Telephone Company. The Commission has formally entered an order reducing telephone rate in New York City whereby an estimated saving of $3,000,000 will be effected for consumers. The order is the same as announced in New York City following the last hearing, and has been accepted by the company. It enlarges the areas for local service without toll charge and places service on a 5-cent-per-message basis for small service, scaling down to a 2.5-cent basis for service in large lots of messages. By the terms of the order the rates are made effective for a period of three years, from July 1, 1915.

OKLAHOMA.

Commissioner A. P. Watson has been removed from the Oklahoma Corporation Commission by impeachment proceedings. Various charges were preferred against him alleging that he had accepted loans from companies under his jurisdiction, and for that reason was not in a position to arbitrate impartially between the public and these companies. No appointment has been made to fill the vacancy.

PENNSYLVANIA.

Right to Purchase.—The attorney general has rendered an opinion in the matter of the York Railway's application for the approval of the Public Service Commission, of the purchase of the Merchants Electric Light Company. The right of a street railway company to purchase and operate an electric light company is affirmed in the opinion.

Wyoming's Public Utility Commission.

Wyoming's first Public Utility Commission, created by the last Legislature, was formally organized on April 2. The Commission consists of Governor John B. Kendrick, State Auditor Robert B. Forsyth and State Treasurer Herman B. Gates. Governor Kendrick appointed H. Allen Floyd, of Sheridan, Wyo., secretary of the commission.

Practical Results of Utility Regulation.

"Practical Results of Utility Regulation by Public-Service Commissions," was the subject of a very interesting address by Henry M. Byllesby, president of H. M. Byllesby & Company, Chicago, before the Electric Club of Chicago on April 8. Mr. Byllesby referred to the increasing number of states which are establishing commission regulation and spoke of this tendency as of permanent benefit to the industry. He thought the opportunity for receiving fair treatment for utilities was infinitely greater in states having commissions than where city councils or state legislatures attempted to control the business. Commissioners, almost without exception, are uniformly honest and in most instances endeavor to give conscientious study to utility problems. This is not true of city or state legislative bodies and politics often enter into the question.

Mr. Byllesby agreed that many mistakes had been made by utilities in the early days of their development, but these were very largely due to the almost phenomenal growth of the business which prevented the establishment of definite policies to be followed.

It is fitting, Mr. Byllesby said, that these methods should be changed but the public should acknowledge the fact that the mistakes of previous years have been corrected. Utilities should now take a firm stand in demanding fair treatment and it is particularly important that valuations, upon which rates are based, should be made fairly and intelligently.

Mr. Byllesby emphasized the importance of considering intangible values when valuating a property and referred to the difficulty of obtaining additional capital if this is not done. He thought the pioneers who have invested money and worked unceasingly to develop a property should be permitted to earn additional rewards if new capital is to be invested to further extend and improve the property.

In conclusion Mr. Byllesby spoke of the increasing tendency to lower rates of utilities while at the same time the taxes are being constantly increased. No commission, so far, has control over both rates and taxes.

Westinghouse Electric Interests in Europe.

Speaking of the recent acquisition of the American interests in the French and Italian Westinghouse Companies by the British Westinghouse Electric and Manufacturing Company, J. Annan Bryce, M. P., chairman of the latter company, said in London on March 29:

"We have of late years had ample opportunity of seeing the working both of the French and Italian Companies and formed the opinion that their want of success hitherto has been due to conditions which we and our American friends are confident that we shall be able to improve. By bringing the work of the two companies' engineering and selling establishments into co-ordination with our own we shall be able to avoid overlapping in both departments, thus saving heavy expenses in development and other work. Both companies have factories well adapted for certain work, and by concentrating at Manchester other work which they have been attempting to do, we shall be able to add to the volume of our own standard manufactures."

Detroit Inspectors Hold Banquet.

The third annual banquet of the Electrical Inspectors' Club of Detroit, Mich., was held at the Edelweis Cafe on Tuesday evening, February 16. Through the efforts of the Banquet Committee a strictly up-to-the-Code menu was provided.

A very enjoyable evening was spent. Among the speakers were F. R. Mistersky, general superintendent of the Public Lighting Commission and patron of the Club; F. L. Lucas, electrical inspector of Toledo, O.; and Lew Borer, electrical inspector of Pontiac, Mich. Remarks were also made by W. E. Flickinger, engineer of the Michigan Inspection Bureau; R. J. Dotson, chief inspector of Highland Park, Mich.; and Edward Watters, electrical inspector of Detroit, and president of the Club.

The closing and very interesting number was an exhibition of the "Pathoscope," the very newest application of motion pictures, by Francis Reno.

The Banquet Committee consisted of James Galbraith, Harvey E. Boyd, Wirt E. Eldert and Benjamin W. Clark, all of the Detroit Inspection Department.

Ohio Meter Conference.

The last regular conference of the Meter Committee of the Ohio Electric Light Association for the season will be held at the Sloan House, Sandusky, O., on April 23. The forenoon will be spent in visiting local plants, and the formal program will begin at 1:30 p. m.

A. H. Bryant, of Cleveland, is chairman of the Meter Committee.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 32.

A 230-volt long-shunt compound motor runs at no load at a speed of 1,200 revolutions per minute and takes a current of 8 amperes from the line. The shunt-field current is 2 amperes and the magnetomotive force of the series field aids that of the shunt field. The air-gap flux for any magnitude of series field current is given in Fig. 27; the magnetomotive force of the series field aiding that of the shunt field in curve A and opposing that of the shunt field in curve B. The shunt-field current in each case is maintained constant at 2 amperes. The armature resistance is 0.12 ohm and the series-field resistance is 0.03 ohm.

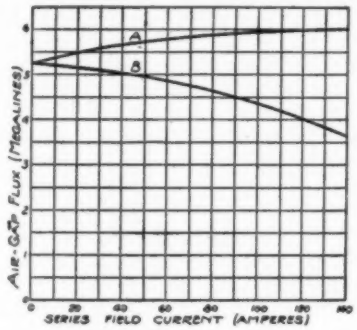


Fig. 27.

The terminal voltage being maintained constant at 230 volts, find the armature speed under the following conditions: (*a*) series field aiding the shunt field, and armature current 45 amperes; (*b*) series field aiding the shunt field, and armature current 90 amperes; (*c*) series field opposing the shunt field, and armature current 45 amperes; (*d*) series field opposing the shunt field, and the armature current 90 amperes. For an armature current of 90 amperes find the armature current-flux torque when (*e*) the series field aids the shunt field and (*f*) when the series field opposes the shunt field.

SOLUTION OF PROBLEM 32.

Answer to Question a.

The joint resistance of the field and armature by [2] equals 0.12+0.03 or 0.15 ohm. The shunt field being connected outside of the series field, the series-field current and the armature current by [13] each equal the line current minus the shunt-field current. The armature current at no load is then 8—2 or 6 amperes. The armature voltage at no load by [3] is

$$E_a=230-6\times0.15=229.1 \text{ volts.}$$

The air-gap flux (Curve A, Fig. 27) corresponding to a series-field current of 6 amperes is 5.4 megalines.

Substituting the known constants in [45] $1{,}200=K229.1/5.4$

and $K=28.3$

Under the conditions of Question (*a*) the armature voltage by [3] is

$$E_a=230-45\times0.15=223.3 \text{ volts.}$$

The air-gap flux (Curve A, Fig. 27) corresponding to a series-field current of 45 amperes is 5.7 megalines. The speed by [45] is

$S=28.3\times223.3/5.7=1{,}110$ revolutions per minute.

Answer to Question b.

The armature voltage by [3] is

$$E_a=230-90\times0.15=216.5 \text{ volts.}$$

The air gap flux (Curve A, Fig. 27) corresponding to a series-field current of 90 amperes is 5.9 megalines. The speed by [45] is

$S=28.3\times216.5/5.9=1{,}040$ revolutions per minute.

Answer to Question c.

The armature voltage as in the answer to Question (*a*) equals 223.3 volts. The air-gap flux (Curve B, Fig. 27) corresponding to a series-field current of 45 amperes is 5 megalines. The speed by [45] is then

$S=28.3\times223.3/5=1{,}260$ revolutions per minute.

Answer to Question d.

The armature voltage as in the Answer to Question (*b*) is 216.5 volts. The air-gap flux (Curve B, Fig. 27) corresponding to a series-field current of 90 amperes is 4.5 megalines. The speed by [45] is then

$S=28.3\times216.5/4.5=1{,}360$ revolutions per minute.

Answer to Question e.

The armature voltage at no load by [3] is

$$E_a=230-6\times0.15=229.1 \text{ volts.}$$

The gross power output by [19] is then

$$P=229.1\times6=1{,}375 \text{ watts.}$$

The speed being 1,200 revolutions per minute at no load the torque is given by

[40] $1.375=1.42\times1{,}200T/10^4$

and $T=8.07$ pound-feet.

The armature current being 6 amperes and the corresponding air-gap flux (Curve A, Fig. 27) being 5.4 megalines, the current-flux torque constant is given by [46]

$$8.07=K6\times5.4$$

and $K=0.249$

With an armature current of 90 amperes and the series field aiding the shunt field the air-gap flux (Curve A, Fig. 27) is 5.9 megalines. The current-flux torque is then given by [46]

$T=0.249\times90\times5.9=132$ pound-feet.

Answer to Question f.

With an armature current of 90 amperes and the series field opposing the shunt field the air-gap flux (Curve B, Fig. 27) is 4.5 megalines. The current-flux torque is then given by [46]

$T=0.249\times90\times4.5=101$ pound-feet.

An examination of the above results reveals the following facts regarding the compound motor.

(1) In the cumulative-wound compound motor the speed decreases as the load increases but decreases more rapidly than in the shunt motor. In this case the speed decreases from 1,200 at no load to 1,040 revolutions per minute at full load. Such a motor is frequently used with a flywheel to drive fluctuating loads. A sudden increase in load reduces the speed of the motor and the energy withdrawn from the flywheel serves to equalize the current taken from the line.

(2) In the differential-wound compound motor the speed may increase as the load increases. This is the only type of motor possessing this characteristic. In this case the speed increases from 1,200 at no load to 1,360 revolutions per minute at full load. If the shunt and series turns are properly proportioned the speed may be made to remain constant independently of the load.

(3) In the cumulative-wound motor the current-flux torque for any given armature current is greater than in the differential-wound motor. Owing to the high inductance of the shunt field winding the current in the shunt field winding builds up more slowly than in the series winding. Hence, in starting, the motor may start in the wrong direction when differential-wound. This may be prevented by short-circuiting the series winding when the motor is started. In driving any machine in which the reactive torque does not increase with the speed the differential-wound motor may accelerate to a dangerous speed and is therefor not suited for such use.

ALTERNATING CURRENTS.

Problem 82.

In the following problem on the concatenation method of arranging induction motors the rotors are coupled mechanically and their windings are connected electrically. The ratios of transformation are equal. In each case the motors are wound for a three-phase, 220-volt, 60-cycle circuit.

(*a*) Two 10-horsepower, four-pole induction motors are connected in concatenation. What is the no-load speed? When the current has its full-load value, what torque does each develop and what is their combined output?

(*b* Two 10-horsepower induction motors, one of which is wound for four poles and the other for six poles, are connected in concatenation. What is the no-load speed? When they deliver ten horsepower, what is the torque developed by each, and what per cent of its full-load value is the torque developed by each?

(c) Two induction motors are connected in concatenation. The first is rated at 15 horsepower and is wound for six poles, and the second is rated at 10 horsepower and is wound for eight poles. What is the no-load speed? What is the output when the first motor takes its full-load current? What is the torque developed by each at this time? What is the greatest load that can be delivered without either motor taking more than its full-load current?

In this problem neglect the exciting currents and all of the losses.

SOLUTION OF PROBLEM 82.

Answer to Question a.

As ordinarily operated, power is supplied to the stationary or stator winding of an induction motor and the rotating or rotor winding is short-circuited. Excepting a motor with a squirrel-cage rotor, the operation would be practically the same if the stator winding were short-circuited and power were supplied to the rotor winding. The synchronous speed of an induction motor is determined by the frequency of the circuit from which it receives its power and the number of poles for which it is wound. The actual speed of the motor is equal to its synchronous speed multiplied by $(1-s)$. s is called the slip. The frequency of the current in the rotor winding is equal to the frequency of the current supplied to the stator multiplied by the slip. The application of these principles determines the speed of induction motors that are connected in concatenation.

Let s_1 represent the slip of the motor that is connected directly to the line and s_2 that of the motor whose stator winding is short-circuited. The speed of the first motor is

$$N_1=(1-s_1)N_s^1$$

N_s^1 is the synchronous speed of the first motor

By [41a] $N_s^1=120f_1/P_1$

f_1 is the frequency of the current supplied to this motor and P_1 is its number of poles.

$$N_1=120f_1(1-s_1)/P_1$$

In a similar way the speed of the second motor should be

$$N_2=120f_2(1-s_2/P_2.$$

But since the motors are coupled mechanically their speeds must be equal so that

$$f_1(1-s_1)/P_1=f_2(1-s_2)/P_2$$

The frequency of the current supplied to the second motor must be the same as the frequency of the current in the rotor of the first so that

$$f_2=s_1f_1.$$

Substituting this value in the preceding equation gives as the relation between the slips of the two motors

$$(1-s_1)/P_1=s_1(1-s_2)/P_2$$

Solving this relation for the value of s_1 gives

$$s_1=P_2/[P_1(1-s_2)+P_2]$$

If this value is substituted in the equation for the speed of the first motor we will have

$$N_1=120f_1(1-s_2)/[P_1(1-s_2)+P_2]$$

At no load the slip of the second motor is practically zero ($s_2=0$), so that

$$N_1=120\times60/(4+4)$$
$$=900 \text{ revolutions per minute.}$$

This is one-half of the synchronous speed of either motor.

When any two induction motors are connected in concatenation the torque developed by the first motor has its full-load value when the current taken by it from the line has its full-load value, and for small variations in the current the torque is approximately proportional to it. The ratio between the torques developed by the two motors is the same as the ratio of their numbers of poles. If the ratios of transformation are equal the current in the second motor is the same as that in the first. Thus in this problem the currents in the two motors are equal, and if one motor is of smaller capacity than the other it will be the first to reach its full-load output.

In this question the motors are of the same capacity and will take their full-load currents at the same time. The torque developed by the first motor will have its full-load value and that developed by the second will be equal to it. Since the speed is practically one-half of the normal full-load speed and the torque has its full-load value, each motor will deliver 5 horsepower and their combined output will be 10 horsepower. The torque developed by each motor is

$$T=5\times33{,}000/2\pi\times900$$
$$=29.2 \text{ pound-feet.}$$

Answer to Question b.

The no-load speed is

$$N_1=120\times60/(4+6)$$
$$=720 \text{ revolutions per minute.}$$

The total amount of torque necessary to develop 10 horsepower at a speed of 720 revolutions per minute is

$$T=10\times33{,}000/2\pi\times720$$
$$=73.0 \text{ pound-feet.}$$

This amount of torque will divide between the motors in proportion to the numbers of their poles, which are 4 and 6 respectively.

$$T_1=4\times73.0/(4+6)$$
$$=29.2 \text{ pound-feet.}$$
$$T_2=6\times73.0/(4+6)$$
$$=43.8 \text{ pound-feet.}$$

The synchronous speed of the first motor is

$$N_1=120\times60/4$$
$$=1{,}800 \text{ revolutions per minute.}$$

The full-load torque of this motor is approximately

$$T=10\times33{,}000/2\pi\times1{,}800$$
$$=29.2 \text{ pound-feet.}$$

The first motor is therefore delivering its full-load torque.

The synchronous speed of the second motor is

$$N_2=120\times60/6$$
$$=1{,}200 \text{ revolutions per minute.}$$

The full-load torque of this motor is approximately

$$T=10\times33{,}000/2\pi\times1{,}200$$
$$=43.8 \text{ pound-feet.}$$

The second motor is also delivering its full-load torque.

Answer to Question c.

The no-load speed is approximately

$$N=120\times60/(6+8)$$
$$=514 \text{ revolutions per minute.}$$

If the first motor takes its full-load current from the line it will develop its full-load torque, which is

$$T_1=15\times33{,}000/2\pi\times1{,}200$$
$$=65.7 \text{ pound-feet.}$$

The torque developed by the second motor is in the ratio of its number of poles to those of the first and thus is

$$T_2=8\times65.7/6$$
$$=87.5 \text{ pound-feet.}$$

The combined torque is $65.7+87.5=153.2$ pound-feet. The output is

$$P=2\pi\times514\times153.2/33{,}000$$

DIRECT CURRENTS.

Problem 33.

The ultimate temperature, dielectric strength and insulation resistance of the armature and field winding of a 25-horsepower, 230-volt, 1,200-revolution-per-minute shunt motor are to be determined after running the motor at full load for several hours. The temperature of the machine (cold) by thermometer is 25 degrees centigrade. Before starting the motor the armature and a variable series resistance are connected across the line and the armature current adjusted to 90 amperes. The difference in potential between two commutator segments, one under the positive brush and the other under the negative brush, is found to be 8.78 volts. These segments are then marked on the ends. The field winding and field rheostat are then connected across the line and the field current adjusted to 2.5 amperes. The potential drop in the field winding alone is found to be 162 volts. The motor with starting box is then connected across constant-potential 230-volt mains, brought up to speed and loaded until the output is 25 horsepower at 1,200 revolutions per minute.

The motor is operated continuously at rated load and speed until the ratio of potential drop to current in the shunt-field winding becomes constant. Under these conditions the shunt-field current is 2.5 amperes and the potential drop in the shunt-field winding is 195 volts. The motor is then shut down and with the armature and a variable resistance connected across the line the armature current is again adjusted to 90 amperes. The armature is turned until the marked segments lie under the same brushes as before and the difference in potential between these segments is found to be 10.8 volts. The motor is then disconnected from the 230-volt mains and all windings are connected to one side of a 500-volt main. The frame of the motor is connected to the other side of a 500-volt main through a 500-volt voltmeter of 60,000 ohms resistance. The voltmeter reads 45 volts. An alternating emf. of 1,500 volts is then impressed between all the motor windings and the frame for one minute.

Find (*a*) the ultimate temperature of the armature windings; (*b*) the ultimate temperature of the field winding; and (*c*) the insulation resistance between all the motor windings and the frame.

This problem illustrates the method for determining the ultimate temperature, dielectric strength and insulation resistance of the windings of a dynamo.

ALTERNATING CURRENTS.

Problem 83—Part I.

A 12-pole induction generator which has a full-load capacity of 1,000 kilowatts is driven by a prime mover whose speed-load characteristic falls from 254 revolutions per minute at no load to 252 revolutions per minute at full load. When delivering full load the slip must be 1.8 per cent. This machine is operating in parallel with a 1,500-kilowatt synchronous generator which is driven by a prime mover having such a speed-load characteristic that the frequency falls from 25.3 cycles at no load to 24.8 cycles at full load. Assume that the power delivered by the induction generator is proportional to its slip.

(*a*) When the induction generator delivers 800 kilowatts, what are the slip, the frequency and the power delivered by the synchronous generator? (*b*) What adjustments should be made so that the frequency will be 25 cycles when these generators divide a load of 2,500 kilowatts properly between them?

Part II.

A six-pole induction generator is operating in parallel with a four-pole synchronous generator. The governors controlling the speeds of these generators are adjusted so that the induction machine will run at practically a constant speed and the speed-load characteristic of the synchronous generator will fall 2 per cent from no load to full load. Both generators are rated to deliver 2,000 kilowatts at 6,400 volts. The hot resistance of the rotor winding between terminals referred to the stator is 0.94 ohm. In determining the output of the induction generator neglect the resistance and reactance of the stator, the reactance of the rotor and all of the losses. This will, of course, give only an approximate solution, but the error is probably within about 10 per cent. (*a*) For what full-load speeds should the governors be adjusted so that these generators will properly divide a load of 4,000 kilowatts delivered at a line voltage of 6,400 volts and a frequency of 25 cycles? (*b*) Without disturbing the governors, how will they divide a load of 2,000 kilowatts delivered at the same voltage?

This problem illustrates the operation of an induction generator in parallel with a synchronous generator.

$=15.0$ horsepower.

The full-load torque developed by the second motor is

$$T=10\times33{,}000/2\pi\times900$$
$=58.4$ pound-feet.

Synchronous speed for this motor is

$$N_2=120\times60/8$$
$=900$ revolutions per minute.

The second motor is delivering 50 per cent more than its full-load torque, and, since the currents in the two motors are equal, it is carrying a current 50 per cent greater than its full-load value. If the current taken from the line is reduced one-third so that it is equal to the full-load current of the 10-horsepower motor, the first motor will be delivering but two-thirds of its full-load torque. The smaller motor, however, will then deliver its full-load torque, so that the total torque developed will be

$$T=2\times65.7/3+58.4$$
$=102$ pound-feet.

The output delivered is

$$P=2\pi\times514\times102/33{,}000$$
$=10.0$ horsepower.

When two motors having the same ratios of transformation are connected in concatenation the output that they can deliver without overloading either is equal to the full-load capacity of the smaller.

Big Expenditure Recommended for Advertising "Electrical Prosperity Week."

An appropriation which will be sufficient to insure the advertising of "Electrical Prosperity Week" in every city and town in the country, was recommended by the Electrical Prosperity Week Committee, which met April 7 at the Engineers' Club, New York City. This recommendation will be submitted to the Board of Directors of the Society for Electrical Development for approval. The board meeting is scheduled for April 19.

It is the belief of all interested that the campaign will be the biggest trade movement of its kind in history. Offers of co-operation from leading electrical concerns and workers of the industry have inspired the leaders in the big campaign to put forth every effort to make it successful.

The committee's recommendation as to plans carried with it an appropriation of $50,000 for special expenditures, such as printing, and extraordinary expenses. In addition to this the Society will devote a large part of its regular appropriation to the work. This will make the Society's expenditures alone far above $100,000. This money will all come from its regular subscription funds contributed by its members. These members will receive the greater benefits from the expenditures, though the whole industry and country will profit in the educational and sales work.

The plans for the campaign, and the fact that it will be handled by the Society under the general guidance of its Executive Committee, have stimulated the Society's growth in membership, particularly in new central-station members.

While the Society will handle the details of the big affair and spend a large sum of money in carrying on the campaign, leading electrical manufacturers and jobbers have declared their intention of spending thousands of dollars in national publicity. Each company will tie its campaign in with the Society's great co-operative movement. Central stations, contractors and dealers will take advantage of the national campaign to obtain local results by handling sales campaigns of their own during the week.

The following named compose the Executive Committee, most of whom were present at the meeting held April 7: chairman, A. W. Burchard, vice-president, General Electric Company; alternate, F. H. Gale, advertising manager, General Electric Company. Gerard Swope, vice-president, Western Electric Company; alternate, E. W. Rockafellow, sales department, Western Electric Company. J. R. Strong, president, Tucker Electrical Construction Company; alternate, George Weiderman, George Weiderman Electric Company, Incorporated. Frank W. Smith, vice-president, United Electric Light & Power Company; alternate, George Williams, Henry L. Doherty & Company. Hugh M. Wilson, *Electrical World;* alternate, Frank B. Rae, Jr., *Electrical Merchandise.*

The subcommittee appointed at the March 24 meeting, reported to the Executive Committee that it had definitely decided upon "Electrical Prosperity Week" as being the most appropriate euphonious and expedient designation. Many names were considered, a large number of authorities were consulted, but in order to make this campaign one that would grip the public and make it popular with the average layman, no better name could be suggested than that given it at the time the campaign was first discussed. It was under the name of "Electrical Prosperity Week" that it received the great mass of publicity in metropolitan and other newspapers and which brought the attention of the public to the movement. The name has met with general satisfaction everywhere and was unanimously approved.

The committee definitely fixed the date of the week to be from Monday, November 29, to Saturday, December 4, 1915. This also met with the approval of the representatives of the various interests. It will furnish the impetus for a "shop early" sales campaign for Christmas electrical goods, and is particularly pleasing to the department-store managers and merchants for it gives them a chance to begin their extra illumination earlier and allows it to continue without a break until Christmas. The after effects of this effort for the holiday season will be of great benefit to the central stations, for the merchants will not feel disposed to go back to less efficient illumination.

The committee recognized the fact that the Society must necessarily have the assistance of experts along certain lines of endeavor. Therefore, it appointed the following committees to work with the Society in determining policies and other important matters. The committees will be known as Advisory Committees and are composed as follows, although other names will probably be added later:

Committee on General Publicity.—H. W. Alexander, Society for Electrical Development; L. D. Gibbs, Edison Electric Illuminating Company of Boston; George Williams, Henry L. Doherty & Company, New York; D. H. Howard, Commonwealth Edison Company, Chicago; W. H. Hodge, H. M. Byllesby & Company, Chicago; Norman Macbeth, *Lighting Journal,* New York; Frederic Nicholas, *Electrical World,* New York; E. R. Kelsey, Toledo Railways & Light Company, Toledo, O.; Don C. Shafer, General Electric Company, Schenectady, N. Y.

Committee on Advertising.—J. M. Wakeman, Society for Electrical Development; Frank H. Gale, General Electric Company, Schenectady; J. C. McQuiston, Westinghouse Department of Publicity, East Pittsburgh, Pa.; N. H. Boynton, National Lamp Works, Cleveland, O.; T. J. Whaling, Westinghouse Lamp Company, New York; Howard K. Mohr, Philadelphia Electric Company, Philadelphia; T. J. McManis, Edison Lamp Works, Harrison, N. J.; Thomas R. Elcock, United Gas Improvement Company, Philadelphia; P. L. Thomson, Western Electric Company, New York; Joseph L. Sullivan, Frantz Premier Company, Cleveland, Ohio.

Committee on Exhibitions, Lectures, Parades, Etc.—George B. Muldaur, Society for Electrical Development; E. W. Lloyd, Commonwealth Edison Company, Chicago; P. L. Thomson, Western Electric Company, New York; F. Nelson Carle, General Vehicle Company, Long Island City, N. Y.; Frank B. Rae, Jr., *Electrical Merchandise,* New York; Ray D. Lillibridge, 111 Broadway, New York; H. N. McConnell, United Gas & Electric Corporation, New York; A. J. Marshall, Electric Vehicle Association of America, New York; E. A. Edkins, Commonwealth Edison Company, Chicago; Frank H. Gale, General Electric Com-

pany, Schenectady, N. Y.; J. C. McQuiston, Westinghouse Department of Publicity, East Pittsburgh, Pa.; Homer E. Niesz, Commonwealth Edison Company, Chicago.

Committee on Local Illumination and Displays.—A. J. Edgell, Society for Electrical Development; T. I. Jones, Edison Electric Illuminating Company of Brooklyn; W. R. Huntley, Buffalo General Electric Company, Buffalo; J. D. Israel, Philadelphia Electric Company, Philadelphia; M. O. Dell Plain, Syracuse Lighting Company, Syracuse, N. Y.; E. R. Davenport, Narragansett Electric Light Company, Providence, R. I.; C. G. Durfee, Rochester Railway & Light Company, Rochester, N. Y.; H. A. Lewis, Hotpoint Electric Heating Company, Chicago; A. A. Gray, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago.

Local committees will be appointed to co-operate in the movement. The names of the prominent men selected by the Executive Committee will be announced soon. The following resolution was passed by the Executive Committee, upon the motion of Frank H. Gale and seconded by George Williams: "That the Nominating Committee's recommendations as to local committees to take charge of 'Electrical Prosperity Week' be approved, with the understanding that these committees are authorized to add to their personnel and that the general manager define the districts covered by each of these committees when notification is sent to these committees."

At the conclusion of the meeting the committee members present expressed their approval of the preliminary plans for the week, to be published soon and also of the work of the Society in this connection to date. It was recognized that the electrical industry had embarked upon the greatest campaign in trade history and one which would be of untold benefit, both from the point of actual sales and in publicity. Figuring all costs it might safely be said that fully a half million dollars will have been spent before its close.

Possibilities for Chinese Electrical Development.

There are great potential possibilities for electrical development in the Szechwan Province of China, states an American consul in his report. Many of its cities have excellent water powers close at hand, the cost of kerosene and other illuminants is very high, and in numbers its population exceeds that of any other Chinese province. Szechwan also is very wealthy, and sooner or later there is sure to be an era of vast commercial development. Large industrial projects are under consideration, and electrical equipment of all kinds will enjoy a very large sale.

CONTINUOUS WAVES IN RADIOTELEGRAPHY.

Monthly Meeting of the American Institute of Electrical Engineers.

The 307th meeting of the American Institute of Electrical Engineers was held at the Engineering Societies' Building, New York City, on Friday evening, April 9. President P. M. Lincoln called the meeting to order at 8:25 p. m. and introduced John B. Whitehead, chairman of the Electrophysics Committee. Professor Whitehead welcomed the members of the Institute of Radio Engineers, who participated in the meeting, and gave a brief introduction to the subject of the evening. He said that radiotelegraphy had progressed to the point where the physical laws governing the transmission of energy were being investigated. Electrical engineers are interested in the subject on account of the fundamental principles involved, and because the equipment now used in radio transmission involves electrical apparatus of considerable magnitude and capacity.

The paper of the evening was entitled "Continuous Waves in Long-Distance Radiotelegraphy," by L. F. Fuller.

Ability to predetermine the probable normal daylight sending radius of high-powered radiotelegraphic stations is of prime importance in their design. The theoretical transmission equations for both continuous and damped waves are discussed and the empirical formulas for the latter are given. Experiments with continuous waves over a period of six months between San Francisco and Honolulu, a distance of 2,100 nautical miles, are described, and an empirical formula for the calculation of probable sending radius with such waves is proposed. The range of wave lengths was from 3,000 to 11,800 meters. Poulsen-Federal arc transmitters rated at 100 kilowatts were used, the usual power being 40 to 50 kilowatts. Antenna currents were measured with hot-wire ammeters, and received watts by the shunted-telephone method. The same transmitting antenna current was used for all wavelengths, or equivalent corrections made. Most of the experiments were during daylight. The formula was checked by experiments between Tuckerton, N. J., and Honolulu, 4,330 miles. Curves giving the energy received at Honolulu from San Francisco under both day and night conditions are shown, and the effects of changes in wave-length upon transmission efficiency are discussed. Evidence strengthening theories of the reflection, refraction and interference of Hertzian waves in long-distance transmissions, and experimental data showing interference bands not over 18 miles in width are given. The great value of easy and rapid changes in wave-length, especially at night, is apparent from the curves. Final conclusions drawn from a comparison of the empirical transmission formulas for continuous and for damped waves are that the transmission efficiency of continuous waves is somewhat higher than that of damped waves on wave-lengths over 3,000 miles, and that this advantage increases with the wave-length. The transmission efficiency of continuous waves generated either by a Goldschmidt reflection alternator or a Poulsen-Federal arc would seem to be the same. In transmissions over distances of the order of 4,000 miles, intervening land appears to be the equivalent of sea water. Evidence of interference at certain wave-lengths was found. The interference bands are not over 18 miles wide.

The paper was discussed by Alfred N. Goldsmith, J. Zenneck, Lee de Forest, A. J. Hepburn, E. F. W. Alexanderson and G. H. Clark.

Professor Goldsmith referred to the importance of the paper with respect to the design of transmitting stations in predetermining their radius of operation. Where continuous waves are used radio engineering reaches common ground with ordinary electrical engineering. It is in using this form of wave that reflection and interference of electromagnetic waves have been observed. It has also led to the development of new methods of receiving, including the use of the rotary pikker, the tone wheel, and the heterodyne system of receiving. The electric arc has become a practicable generator of high-frequency sustained waves, and this apparatus is distinguished by unusual simplicity in making rapid changes in the transmitted wave-lengths possible. He then referred to the sunrise effect and the reasons for it.

Dr. Zenneck questioned the author's statement that audibility is proportional to the received watts. In comparing the author's results with those of Dr. Austin, he said that values were comparable only where the same wavelength was used. In this range, from 3,000 to 4,000 meters, the results were in good agreement. The conclusion that the divergence factor with undamped waves is less than for damped waves, is based upon extrapolation outside of this range, and is, therefore, unfounded. A similar comparison for waves shorter than 3,000 meters would lead to an opposite conclusion.

Dr. de Forest told of the conditions of operation which led to the first observation of interference effects between the stations at San Francisco and Los Angeles. At the time the results were obtained they were not understood, but they become simple now that it is realized that interference is the cause. He emphasized the importance of being able to change the wavelength quickly at will.

The written discussion of Lieutenant-Commander Hepburn was read by David M. Mahood, Jr. After pointing out the importance of the author's experiments, he stated that a transmission theory is needed more than a transmission formula. The Navy Department has contemplated work along

this line for several years, and has planned systematic experiments between the Washington Navy Yard, the Bureau of Standards, and Annapolis, Md. Such experiments should consider the effects, independently, of the height of transmitting and receiving antenna, the antenna amperes, the wave-length, the decrements due to resistance, and to different forms of antenna, etc. Complete data along such lines would undoubtedly lead to changes in the form of the transmission formula. This is indicated by the following considerations: (a) Instances of unusual communication which do not accord with any known theory. (b) Effects of reflection from the surface of the earth, as well as from an upper atmospheric layer, should be considered. (c) Mr. Fuller's statement that the received energy did not always increase with the antenna current above a certain limit. (d) The existence of interference bands makes quantitative measurements at a fixed station doubtful. (e) Everyday work shows the superiority of undamped waves to be much greater than indicated by Mr. Fuller's formula. (f) Conductivity of the earth and the sea should be considered.

Mr. Alexanderson referred to the importance of the ability to predetermine transmission distances, etc., in the design of apparatus for a station. The results given suggest that for distances over 2,000 miles frequencies from 15,000 to 25,000 cycles should be used. An alternator for long-distance work has been completed at Schenectady, designed for 50 kilowatts at 50,000 cycles. This machine has a speed range from 1,800 to 3,600 revolutions per minute, and to obtain the corresponding frequency no other tuning is needed than the tuning of the antenna itself. The alternator can be speeded up until this frequency is reached, when it automatically comes into synchronism and the resulting load prevents the speed from going any higher. The speed is then stable, and can be changed only by changing the tuning of the antenna. Signals can be made by throwing power on and off, and the speed fluctuates only imperceptibly.

Mr. Clark referred to experimental results on the measurement of decrement, and its relation to the received current. These did not agree with the Austin formula, as the decrement had a marked effect on the energy. When using different wave-lengths a marked maximum had been found in the received energy for constant applied power. In Mr. Fuller's experiments the current in the antenna was kept constant rather than the energy delivered from the source, and there should be a maximum corresponding to the most effective wave-length for the given antenna. Between Honolulu and San Francisco, such a maximum is shown for 7,000 meters.

In closing the discussion, Mr. Fuller referred to the difficulties involved in making measurements of the kind necessary for this apparatus. No empirical formula derived from such experiments, with either continuous or damped waves should be considered final.

The meeting was followed by a smoker.

Census Figures on Bell Telephone System.

The Bell telephone system in 1912 controlled nearly 75 per cent of the total wire mileage and over 58 per cent of the total number of telephones in use in the United States. It also controlled nearly 51 per cent of the public exchanges maintained by companies with annual incomes of $5,000 or over, and handled 66.5 per cent of the calls made over the lines of such companies. The wire mileage of the Bell system increased from 8,947,000 in 1907 to 15,133,000 in 1912, or by more than 69 per cent. During the same time the wire mileage of all other systems combined increased from 4,052,000 to 5,115,000, or by a little over 26 per cent.

The telephones under the control of the Bell system numbered 3,132,000 in 1907 and 5,087,000 in 1912, the percentage of increase being 62. The number of calls handled by the Bell system increased from 6,401,000,000 in 1907 to 9,133,000,000 in 1912, or by nearly 43 per cent.

Increasing Use of Electric Fans in India.

Electric fans, both of the ceiling and wall types, are coming into more general use in India and are replacing the hand-operated Indian punkahs. Nearly all offices in the large commercial cities are now equipped with electric fans; also clubs, places of amusement, churches, and the residences of the European sections of the cities.

Annual Report of Western Electric Company.

The annual report of the Western Electric Company for the year ending December 31, 1914, shows sales of $66,408,000, as compared with $77,532,000 for 1913. President H. B. Thayer says that business conditions affecting this company's prosperity have been steadily getting worse through the year. The prospects for 1915 are not encouraging. As is always the case, the expenses do not decrease as rapidly as the sales, and at this time there are certain expenses connected with the development of new apparatus which it does not seem wise to curtail.

The orders on hand on January 1, 1915, were $4,309,000 in value less than on January 1, 1914. The number of employees on January 1, 1915, was 15,650, as compared with 19,856 on January 1, 1914. Business conditions are also reflected in the balance sheet by reductions in merchandise and receivable accounts, and by the increase in cash on hand.

It will be impossible until after the close of the European war to report the effect of the war during this year upon the company's foreign investments. A loss of profits and some loss of property is expected, on account of which the company may later have to make revaluations.

The total disbursements from the Employees' Benefit Fund for 1914 amounted to $154,373. These payments covered all classes of benefits and were made to 2,209 beneficiaries.

Earnings for 12 months ending December 31, 1914, were as follows:

	1914	1913	1912
Sales	$66,408,484	$77,532,860	$71,727,329
Other income	948,509	720,556	1,194,010
Total income	67,356,993	78,253,416	72,921,339
Manufacturing costs, expenses, etc.	63,323,526	71,689,555	67,211,339
Reserve for contingencies	500,000	2,500,000	2,000,000
Net earnings	3,533,467	4,063,861	3,710,000
Fixed charges	862,507	892,166	856,735
Reserve for Employees' Benefits	.....	.....	285,855
Excess available for dividends	*2,670,960	3,171,695	2,567,410
Dividends	1,500,000	1,500,000	1,500,000
Carried to surplus	1,170,960	1,671,695	1,067,410

* This is equivalent to 17.8% earned on the $15,000,000 capital stock, as compared with 21.1% earned on the capital stock for 1913.

The general balance sheet compared with previous years, is as follows:

	1914	1913	1912
ASSETS—			
Total plants	$19,217,809	$18,703,823	$10,341,564
Merchandise	15,497,147	16,966,856	18,947,164
Cash	5,242,421	2,393,175	2,317,885
Bills and accounts receivable	24,162,774	26,025,074	26,155,609
Sundry investments	9,349,059	9,979,390	4,388,710
Total	73,469,210	74,068,318	62,150,932
LIABILITIES—			
Capital stock	$15,000,000	$15,000,000	$15,000,000
First mortgage 5% bonds	15,000,000	15,000,000	15,000,000
Other bonds	.....	.....	81,501
Current liabilities	3,210,970	5,660,517	6,329,686
Reserve for depreciation	11,449,912	11,022,235	.....
Reserve for Employees' Benefit Fund	1,000,000	1,000,000	1,070,000
Reserve for contingencies	3,796,909	3,545,107	3,500,981
Surplus	24,011,419	22,840,459	21,168,764
Total	73,469,210	74,068,318	62,150,932

Fessenden Oscillator to Detect Submarines.

It is announced that one of the European powers now at war has decided to equip its battleships with the Fessenden electric oscillator. The instrument is the invention of Prof. Reginald A. Fessenden who has recently returned from Europe where it is understood he submitted his invention to the power referred to. This announcement was made in the April issue of the *American Magazine* by Cleveland Moffett. The following discussion of this topic is abstracted from the New York *Times*.

"To put it simply," says Mr. Moffett, "this Fessenden oscillator is a submarine sounding apparatus that can send its signals through the water, not through the air, one result being that these signals travel more swiftly than they would through the air since sound travels through water at the rate of 4,400 feet per second, while through the air it moves at the rate of only 1,100 feet a second. His system of submarine signaling is really a kind of water wireless, destined perhaps to as important a development as aerial wireless."

Mr. Moffett gives a verbatim report of a talk he had with Professor Fessenden. The inventor said he was convinced that it would be possible to transmit these underwater signals, using the regulation Morse code, over a distance of one hundred miles. A battleship equipped with the instruments, he pointed out, could talk with its own submarines when they were miles away and direct their movements against an enemy's vessels. Professor Fessenden said that the oscillators already were installed on the American dreadnoughts *Wyoming, Utah, Delaware* and *Florida* and the submarines of the "D" class.

Professor Fessenden said a vessel would need two of the instruments, one on either side, which would enable an officer to determine the direction from which the signal comes. The battleship, he added, would be able to tell within a few degrees the position of the submarine. This would be made possible by a distance indicator with a dial graduated in thousands of yards.

In answer to a question as to whether his invention did not increase the terrors of the submarine, Professor Fessenden replied:

"That is true for dreadnoughts not equipped with oscillators, but for others that are able to listen with electrical ears, the submarine becomes far less formidable. The oscillator makes it possible for a ship's officer to hear the propeller movements of an enemy's submarine while it is miles away. With our existing apparatus we can detect such propeller sounds at a distance of two miles, and we have a sound-amplifying device that will extend this distance to five miles or more."

"Does that mean safety for battleships from submarine attack?"

"A great measure of safety, yes."

"Then those three British cruisers that were sunk by German submarines could have escaped if they had carried these listening oscillators?"

"Unquestionably."

"What would they have done?"

"As soon as they heard the propeller noises of the attacking submarines, which would have been some time before the German torpedoes were launched, they would have changed their courses and gone ahead at full speed. That would have baffled the enemy, for submarines are slow-going craft and only dangerous when their presence is not suspected. It is even possible that the British cruisers, knowing by dial indications the approximate distance and also the direction of the submerged German vessels, could have destroyed them by launching torpedoes of their own."

The oscillators are placed forward of amidships and are submerged three or four fathoms.

Telephone Troubles in the Tropics.

W. Llewellyn Preece, in a paper read before the Institution of Electrical Engineers in London, on telephone troubles in the Tropics, said that men who had never been in the tropics seemed unable to realize that the climatic and other consequent troubles experienced in those parts differed so much from what were met with in any other part of the world. These troubles gave the engineer who was responsible for the maintenance of a telephone system in a tropical country more worry and anxiety in one week than his colleagues elsewhere experienced in a year. It was not so much the actual heat itself that was to blame—the temperature rarely exceeded 96 degrees Fahrenheit. The main troubles were due to the damp and to the many natural effects caused by damp heat. When it was grasped that in many places the humidity of the atmosphere varied between eighty and ninety per cent it was possible to appreciate the reasons for the telephone engineer's more or less emphatic complaints. The marvelously rapid growth of vegetation, due to the damp heat, and the equally prolific insect life, if understood, would evoke sympathy for tropical engineers. Lightning and the effects of electrical atmosphere upon human nerves, and the troubles caused to line and pole construction by wild animals, were also mentioned by Mr. Preece. In East Africa, giraffes have caused serious difficulties with the field telegraphs owing to bamboo poles not being obtainable long enough to raise the wire above the heads of these long-necked animals, which have not the sense to draw back and duck their heads, but push on and on, carrying wires and sometimes poles with them. Mr. Preece's main reasons for bringing the subject forward were to impress upon electrical men at home the serious difficulties met with in telephone engineering in tropical countries, to help manufacturers to realize the treatment that their apparatus was bound to experience in those parts, and to elicit hints which would go toward relieving their hard lot. The author took each section of a complete telephone system in turn—the subscriber's instrument, the exchange switchboard, and the line—so that the various peculiar faults experienced might be more clearly understood. The paper, however, possessed a wider interest than that of telephony and telegraphy, for it contained points of value in connection with heavy electrical installations, especially where overhead transmission lines are employed.

The use of teak for instruments practically prevents the ravages of white ants. Mr. Preece exhibited an instrument to which a swarm of bee-like insects of Nigeria took a great fancy to use as a hive; they entered by the slot of the switchhook, and the comb was formed in the interior. Many times the comb was cleared out, but the insects re-formed it, until in despair the whole apparatus was removed. It is no uncommon experience in the tropics to find instruments entirely *hors de combat*, through diligent work of the spider, which is a real pest. For these reasons the telephone case must be closely sealed up, and the switch hook should carry a brass plate which keeps the slot in which the arm works entirely covered. No terminals should be above the instrument, the conductors being taken through holes into the case and the holes sealed up. Internal wiring should be simple, the wires not being bunched; enamel insulation with a silk covering is generally very suitable, but enamel insulation does not always give satisfaction. Ebonite sheaths of receivers become soft and pliable in a tropical climate; this can be easily remedied by using blocked brass sheaths covered with enamel. Much trouble has been caused by the insulating block, which carries the contact springs in a capsule transmitter of a microphone, being warped by the damp heat, so that both springs touched the metal case of the capsule and short-circuited the microphone.

In the course of his references to troubles due to the subscriber's ill treatment of the instrument, Mr. Preece mentioned the case of an irate owner of a rubber estate who when his complaint was investigated was found to be using the mouthpiece of his micro-telephone, which hung from a wall instrument by his desk, as a cigarette ash tray, and the microphone was full of tobacco ash! In regard to exchange switchboards, while until lately the craving of the tropical engineer has been to have the up-to-date central battery system, the present tendency is to make a demand for an automatic system. Mr. Preece referred to an insuperable obstacle in this connection. The maintenance of really satisfactory insulation on overhead

lines is almost impossible in the tropics, and if with this poor insulation a pressure of 24 to 40 volts was applied to the line, even moderately fair working of the system would be extremely doubtful. Mr. Preece has, therefore, set himself strongly against the central battery board, unless a government is prepared to place the whole system underground, and usually this is prohibitive. He is equally against the automatic, and is entirely in favor of a magneto system, using either mechanically restored indicators or incandescent lamps controlled by relays.

The question of operators causes the traffic department considerable worry. In the delightful climate of Nairobi, East Africa, European girl operators give every satisfaction, but if even in the temperate zones operators find their work trying to the nerves, they must suffer far more in the electrical atmosphere of the tropics. In the majority of tropical places it is impossible to employ European operators, and owing to lack of ability, early marriage or form of religion, native female operators are also unsuitable. For instance, no Mohammedan woman can take on such work at all. This means that the government must rely on half-caste girls or native men, neither of whom, with rare exception, have mental equipments comparable with those of European women. Only 60 lines to a position can be managed in some places, and 80 per position is generally quite as much as can be handled, therefore the longing of telephone departments for simple automatic system can be understood. Subscribers object to "ringing off" after conversation, and to avoid this source of annoyance in the exchange and the consequent delays in freeing cord circuits, an automatic clearing signal had been fitted to all the boards in the Malay states, even to those for 50 subscribers.

One of the line troubles that the tropical engineer experiences is caused by insects, which delight in making their homes between the petticoats of insulators. Mr. Preece has seen an insulator so covered with a spider's nest as to be itself invisible, the base of the nest being on the arm and the apex above the insulator. This was an extreme case, and was on a line which ran through the jungle, and had not yet been brought into use. Constant attention on the part of linesmen is necessary to prevent insects getting such a hold on insulators. It was quite usual to find formed in a single night webs glistening with dew and connecting the wire to the insulator stalk, the insulation resistance of the line being reduced in consequence of this to a very low value.

BOOK REVIEWS.

"Principles and Practice of Electrical Engineering." By Alexander Gray. New York: McGraw-Hill Book Company, Incorporated. Cloth, 392 pages (6 x 9 inches), 449 illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $3.00.

According to the author's statement this book is based on a lecture and laboratory course given to the senior, civil, mechanical and mining students at McGill University. It is thus an elementary treatment of nearly the whole field of electrical engineering. The first five chapters are devoted to a discussion of the general electric and magnetic principles which serve as an introduction to direct and alternating-current theory. Subjects not ordinarily found in texts of this nature are included, thus a chapter is devoted to "Automatic Starters and Controllers," another to "Car Lighting and Variable-Speed Generators," another to "Electric Traction" and still another to "Electric Lighting." In all there are 43 chapters in the text. In the last chapter is outlined a series of 20 well selected experiments.

Of making books there is no end, and one is sometimes tempted to ask what good purpose can be served by publishing another text when there are already so many on the market. This question would be entirely out of place with reference to this book. The reviewer is so favorably impressed with the author's selection and presentation that he is reminded of a mishap that once befell a Freshman, who in one of his themes used the words of Macaulay too freely and without proper credit. When his instructor remonstrated he excused himself by saying "I could not have said it better myself." The book is exceptionally well arranged; the treatment is lucid without being verbose; the figures and diagrams are likewise well drawn and serve to elucidate the theory. In addition the theory is given a practical bearing. In short, for the class of students for which the text is intended, the reviewer knows of nothing better; there is so much to commend and so little to criticize.

The chapter on controllers and starters, both hand-operated and automatic, deserves special mention. It is one that can be read with profit by students of electrical engineering. This is usually given scant treatment in electrical engineering texts. From the table of contents in the front to a most complete index in the back part, the book is full of "meat."

C. M. JANSKY.

"Lektrik Lighting Connections." By W. Perren Maycock. Third edition. London: A. P. Lundberg & Sons. Paper, 133 pages (3x4¼ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for 25 cents.

The new edition of this valuable little summary of the art of switching, put in form for the vest pocket, comprises 60 more pages and 77 more illustrations than the last edition. It will be found convenient for reference by all those who meet with problems requiring special arrangements to permit of giving control of lighting circuits from the proper combination of points. While drawn up with special reference to the use of switches manufactured by the publishers, the connections are nevertheless suitable for other types of switches. The author has given a very thorough study to the problems involved.

"Wiring of Finished Buildings." By Terrell Croft. New York: McGraw-Hill Book Company, Incorporated. Cloth, 275 pages (5¼x8 inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

It would be hard to find one better fitted than the author of this book to present the subject which he has taken up and discussed in a very readable manner and with profuse line illustrations. The book comprises two parts, the first dealing with the commercial aspects of the matter and taking up the possibilities for development of the business, methods of advertising to be followed in wiring campaigns, the solicitation of customers and general policies to be followed. This portion of the subject is handled principally from the standpoint of the central-station contract agent. Examples of campaigns which have been carried on by various central-station companies are given. There is also a chapter on costs and prices, in which methods of estimating and of determining standard unit prices is explained. Portions of the matter in this part of the book are taken from the committee reports of the National Electric Light Association.

Nearly two-thirds of the book deals with the actual work of carrying on wiring in this class of building, not only the general forms of wiring used in this country, such as rigid conduit, flexible conduit, flexible armored cable, knob-and-tube work and metal and wooden molding being discussed, but also the methods used in Europe and which are the subject of so much discussion in this country at the present time, designated as concentric wiring. In this connection particular attention is given to the Kuhlo method, which is fairly typical of this class. Other chapters cover the subjects of planning installations, tools and manipulation, examples of installations, and fixtures. The subject is handled in a thoroughly practical manner and this portion of the book should be of great value to both contractor and wireman. Quite a bit of the material has already appeared in periodicals, at least three of the articles recently published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN being incorporated in full.

New Electrical and Mechanical Appliances

A New Combination Electric Cooking Appliance.

It is said that the use of electricity for general cooking purposes increases proportionately as the development of satisfactory appliances for the purpose. Manufacturers of electric household appliances have for years tried to create an appliance that would do the ordinary cooking in the average family in a satisfactory and economical manner, and yet produce a device in compact form, of high utility, and at a price within the reach of all.

The Hotpoint Electric Heating Company, Ontario, Cal., believes it has attained this goal in "El Grilstovo," a new appliance combining the functions of the electric grill and stove, and utilizing the principles of the open-coil reflector-type electric stove.

The new appliance, here shown, cooks two articles at once on the same current, one above and the other below the heating element; using ordinary kitchen utensils above, and a special extra-deep underdish below the glowing coils.

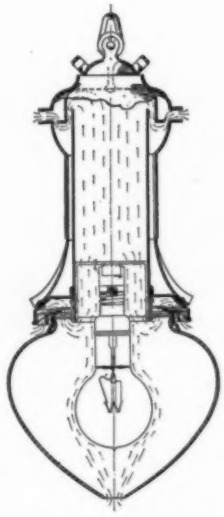
According to officials of the Hotpoint company, the utility of El Grilstovo is such as to commend it to housewives who are in search of better results in their household duties, at the same time lessening the effort required. The low list price will be further reduced during "Hotpoint Week," next month, insuring extensive sales.

Hotpoint "El Grilstovo."

It is stated that the advance orders received at the Hotpoint factories, in Chicago and Ontario, for El Grilstovos are twice as heavy as the volume received for last year's "Hotpoint Week" specialty at the corresponding season. The Hotpoint company is preparing for the greatest sale, both of El Grilstovos and of Hotpoint irons at the permanently reduced price that it has ever had since the first annual Hotpoint co-operative sale was inaugurated some five years ago.

Converting Arc-Lamp Casings Into Containers for Nitrogen-Filled Lamps.

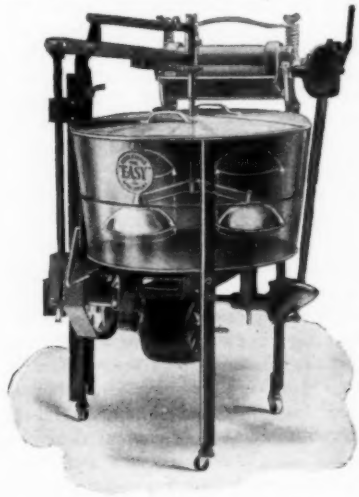
Since the introduction of the gas-filled tungsten lamps a little over a year ago, they have been rapidly superseding the older types of arc lamps, particularly for street lighting. To reduce the cost of this substitution it has been thought desirable to utilize the old arc-lamp casings as containers for the new lamps. To this end the Metropolitan Engineering Company, 30 East Forty-second Street, New York City, has devoted much study, as the result of which an effective and simple means of making this conversion has been developed.



Section of Converted Lamp.

From an operating standpoint there were two factors to contend with, first the absolute elimination of rain water in contact with the lamp bulb, and second, so housing or inclosing the lamp that the leading-in wires in the lamp would be operated at the lowest possible temperature. The first was accomplished by the introduction of baffle plates within the housing and so designed as absolutely to eliminate the entrance of water and still provide sufficient clearances to permit air-stream flow with the least possible resistance. As is well known, in this type of lamp when burning tip down the lamp base and all that section of the lamp within the cylindrical formation are subjected to comparatively high temperature and it was found essential to so design a unit as to operate this particular section at the lowest possible temperature.

With this object in view, many tests were conducted, finally resulting in the unit shown in the cross-sectional view herewith, where it will be noted that the entire design takes the form of a chimney with cold air entering beneath the lamp at the bottom of the globe which rises rapidly and becomes heated after enveloping the lamp bulb, passes upward with considerable velocity and in so doing induces a volume of cold air to enter above the top of the globe as illustrated. This particular cold air stream entering above the globe top and being directed against those lamp parts liable to high temperature causes them to actually operate at a temperature lower than would obtain if the lamp burned in free atmosphere.



Dodge & Zuill Electric Washer.

New Dodge & Zuill Electric Vacuum Washer.

The illustration herewith shows the new model F washer recently added to the line of vacuum plunger washers manufactured by Dodge & Zuill, Syracuse, N. Y.

A particularly useful improvement in this new washer is the provision that has been made so the plungers can be tipped back out of the tub where they are en-

tirely out of the way after the washing is finished, giving free access to the inside of the tub

To accomplish this result, the cover of the tub is made in two parts and the plungers are supported from a lever which projects over the tub from side to center, as shown in the illustration. To remove the plungers all that is necessary is to loosen a wing nut, remove the covers and turn the horizontal lever back on its axis where it connects with the vertical drive rod.

The new washer is made entirely of metal. The tub is solid copper, tin lined. The cover, operating lever and its connections inside the tub are galvanized. The frame, legs and other parts are solid metal, black enameled. For portable service the legs are provided with ball-bearing casters. Floor rests are provided where the washer is to be installed in a permanent position.

The vacuum plungers are made of solid copper. These plungers move up and down 63 times per minute. The air contained in these plungers on the down-stroke forces the water through the mesh of the garments, while on the up-stroke the vacuum sucks the water back through the fabric. This cleanses quickly and thoroughly without subjecting the fabric to the wear caused by rubbing or dragging the clothes over corrugated surfaces. A spring in the plunger head provides automatic adjustment to afford protection against overload.

The model F machine has a capacity of six sheets, or the equivalent. The diameter of the tub is 23 inches inside at the top, 20.5 inches at the bottom and the height is 12.75 inches. The bottom is fitted with a discharge valve for sewer or hose connection.

The wringer frame is made of malleable iron, galvanized. It is equipped with steel ball bearings. All gears are inclosed. The lever at the end of the wringer starts, stops or reverses the wringer instantly. The wringer is equipped with a reversible water board to drain either into the washer or laundry tub as desired. It is provided with a wood roller to facilitate the movement of the clothes over the apron board into the tubs.

The motor is of one-eighth horsepower capacity and is made by the Robbins & Myers Company, Springfield, O. It is mounted directly under the tub where it is out of the way. All gears in the transmission are thoroughly protected by guards. The vertical bar which drives the wringer can be disconnected easily and dropped to a horizontal position for operating ice-cream freezers or other equipments of this kind.

Telephones have displaced telegraph instruments for train dispatching on 60,000 of the 250,000 miles of railroads in this country.

New Capital Electric Washer.

To meet the demand for a washing machine of a design similar to its original machines but of smaller size and lower price, the Capital Electric Company, 321 Sheldon Street, Chicago, has placed on the market the new Geyser, six-sheet capacity machine shown in the accompanying illustration. The most striking feature of this machine, aside from its low price, is its attractive appearance and the absence of any external gears and shafts or other operating mechanism. It is truly a "safety first" machine and this feature has been strictly adhered to throughout the entire design.

The principle of washing in this machine, as in the other models manufactured by the Capital Electric Company, is a radical departure from the usual practice. An inclosed motor is placed directly beneath the tub and is directly connected to a propeller or fan located just inside the tub. This propeller, in action, forces a stream of hot suds through the clothes which are placed in a perforated zinc cylinder within the tub. The cylinder is given a rotating motion at the same time by reason of the force of the water directed through the clothes. At the opposite side of the cylinder there is a suction action, produced by the continuous circulation of the water, that draws the hot suds downwards through the clothes, thus intensifying the cleaning action.

Geyser Electric Washer.

By this method of washing the hot, soapy water is forced through all of the pores of the clothes, regardless of the density of the fabric, and it is claimed that from 10 to 12 minutes is all that is required to complete a washing, no boiling being necessary. Since the cylinder in which the clothes are held is perfectly smooth and there are no mechanical agitating or pulsating parts within it, there is no tearing or wear on even delicate fabrics.

The cylinder is held in place by two bearings with spring catches which secure it in position when the handle is lowered. To raise the cylinder in position for wringing it is simply necessary to raise the handle and engage the cylinder shaft in two other bearings, the travel being guided by suitable tracks. In this position the cylinder cover can be folded back so as to form a path for the clothes to the wringer.

he wringer is reversible and is provided with a safety release mechanism. The wringing operation can be carried on separately or simultaneously with the washing. The driving shaft and gearing for the wringer are entirely inclosed, the former inside the tub.

Energy to the motor is controlled by a snap switch located on the wringer. The motor is started and stopped by a foot switch so located that the operator can control the operation of the machine while engaged in either wringing or handling clothes in the washer.

An idea of the simplicity of construction, compactness and ruggedness of this machine may be had from the accompanying illustration. The framework is of angle iron, secured by welded rivets, and is mounted on universal casters, thus making the machine readily movable from place to place. The tub is of heavy galvanized steel surmounted with oak panels at the top. The cylinder is of zinc. If desired, a copper tub can be obtained at a slightly additional cost.

New Steam Turbines on Swedish Steamships.

The American consul general at Stockholm, Sweden, reports that a new kind of turbine has been introduced on some of the ships which ply between Lübeck and Goteborg, Sweden. One of these steamers has just finished a maiden trip to Goteborg, where it has been inspected by a party from the technical academy of that city. It is claimed that 40 per cent coal has been economized during the journey, an item which is of the greatest importance at the present time.

A Lamp-Socket Energy Economizer.

The advent of the high-efficiency low-wattage tungsten lamp has created a big demand for an inexpensive and economical means for "turning down" or dimming electric lights, and the lamp-socket attachment, known as the Eaco Turn-lo Reducer, recently placed on the market by the Electrical Auxiliaries Company, 1842 Morse Avenue, Chicago, Ill., is a most ingenious little device for accomplishing this purpose on alternating-current circuits.

There are a number of devices on the market in one form or another for performing the same purpose as this new reducer, but they are either uneconomical of energy consumption or else of delicate construction or high first cost and maintenance. If economy in power consumption is to result from the use

Fig. 1.—Turn-Lo Socket-Voltage Reducer.

of devices of this kind, when the load consists of high-efficiency low-wattage lamps, the internal losses of the device must be exceedingly small indeed, because the energy consumed by the lamp itself, even at normal voltage, is not large.

The Turn-lo attachment and energy economizer is simply an inductance coil which may be connected in series, wholly or in part, with the lamp or similar load. During full illumination, that is, normal operation, the inductance is short-circuited upon itself, and thus not subject to losses of energy; while for conditions of reduced illumination a part of the whole of the inductance is connected in series with the lamp filament.

The constituent parts of the Turn-lo economizer consist of three essential parts: the winding, the magnetic circuit and the switch. The coil consists of a number of turns of wire from which one or more taps are taken off. The number of turns used in this coil is relatively low on account of the efficient arrangement of the magnetic circuit. Since the coil is never called upon to carry even the full-load current of the lamp, which is of small magnitude, the size of wire used need not be large and the coil is very small and compact. The use of enamel, which is a good dissipator of heat, for the insulation permits of a further reduction in the size of the wire and coil. The magnetic circuit consists of a central cylindrical core and an outer shell of magnetic material, both wound in the form of a spiral, with end pieces tightly clamped at each end. Between the two spiral cores is placed the solenoid winding. Insulation is inserted between the end pieces and the main core, thus introducing an air gap at each end of the magnetic circuit. An important feature of this air gap is that it enables the inductance of the device to be adjusted for any value that may be required within reason. It is, however, recommended that as a general rule such adjustment be left to the manufacturer or other capable parties.

There are a number of advantages from having a core of the shape described above; a maximum inductance is obtained with the smallest amount of material in the smallest space; the core is absolutely noiseless, even at extremely high flux densities and over a very wide range of frequencies no sound is audible. Silicon steel of the finest quality is used, reducing the hysteresis loss to the lowest possible amount, while the spiral shape of the main core, the radial slotting and efficient laminating of the end pieces permit the eddy-current loss to be kept at a very low value.

The switch, by means of which the reduced voltages are obtained, may have two or more points, depending upon the number of reduced voltages desired. Since the switch short-circuits the reactance during the period of heaviest current, that is full candlepower of the lamp, and as the switch is at no time called upon to interrupt the main current, because there is always a circuit in parallel with the switch contacts, there is no tendency for the switch to heat, arc or burn. The switch is rugged and strong, but to prevent undue strains being imposed upon it, and thus subjecting the switch mechanism to abuse, a part of the switch stem is made flexible, which eliminates those troubles which are of such common occurrence with the ordinary switch.

It is a matter of experience that the heat conducted through the socket of lamps of high wattage has in some cases been sufficient to permanently affect the insulation. In the design of the Turn-lo voltage reducer particular attention has been given the possibility of relatively high temperatures being attained, and care has been taken that no material be used in this appliance which can suffer disintegration or damage under the influence of heat, by using mica for insulating the core, while enamel is used to cover the wire. Ample insulation is used throughout and there is thus no danger of any part of the metallic case becoming alive, as is exemplified by the high-voltage breakdown test of 1,000 volts to which all finished articles are subjected. The whole device is inclosed in a very neat metal case finished in all the standard finishes in use on lighting fixtures.

Fig. 1 shows the general appearance of the voltage reducer, and Fig. 2 shows

Fig. 2.—Reducer and Lamp Applied to Socket.

this device fitted to a lamp socket and a 40-watt tungsten. It will be seen that the whole affords a neat and unobtrusive appearance. The switch knob is so located that it is at all times discernible, whatever the intensity of the illumination, and thus there is no necessity for one to fumble around in the shadow above while trying to find the switch. The reducer can, of course, be placed inside the reflector if desired, although this is not to be generally recommended on account of the changed distribution of light which would occur.

From the foregoing it is evident that the Turn-lo lamp-socket attachment is an efficient, simple, reliable and inexpensive device. It is a practical piece

of apparatus containing nothing which can get out of working order, and capable of standing hard every-day service. The device is at present on the market in four standard sizes, namely, for 25, 50, 100 and 660 watts, respectively. Each size of attachment is able to take care of all loads between its rated load and the next lower load; for instance, the 25-watt Turn-lo is suitable for 20 and 15-watt lamps, and the 50-watt Turn-lo is suitable for the 50-watt carbon lamp and the 40-watt tungsten, etc., etc. The largest capacity Turn-lo can, of course, be used to control the smallest lamp, but the range of light reduction and consequent economy will not be as great as were a Turn-lo of more appropriate size used; conversely, the largest lamp can be used with the smallest Turn-lo, but in this case, with the attachment turned down the light intensity will be insufficient to make visible objects in a darkened room. The three former sizes are usually recommended for the control of lighting units in residences and stores, whereas the latter is for the larger lighting units and for the control of small motors and similar current-consuming appliances. The smaller economizers are ordinarily designed to give two values of inductance, that is, three different voltages altogether; while the larger one gives three values of inductance or four different voltages, and these have been found to be ample for all practical conditions.

So far, the application of this device to incandescent lamps only has been considered, but its use is not confined to lighting units alone. It is finding a ready market for the control of fans, small motors, flatirons, etc., where its efficiency, compactness, safety and ease of handling make it a very useful and money-saving little piece of apparatus.

In some cases this device has been the means of enabling electricity to be used where before gas held the field. For example, it is well known that the inability to regulate readily and economically the heat input to electric flatirons, even within quite wide limits, has prevented the adoption of electricity for numerous classes of work, and this has enabled gas to remain without a competitor in such cases. However, this is no longer true because the heat input to electric irons can now be controlled by means of the Turn-lo attachment with sufficient closeness for any demand on the market today. Many types of fans are equipped with only one speed and it is often required to use a speed or speeds other than that supplied; this can readily be accomplished by means of the new reducer. Fans are usually employed only in the summer, but their use would often prove efficacious in the winter for heating purposes. For this purpose the fan should be placed before the steam-heated radiator in such a manner that the heated air around the radiator becomes agitated and distributed around the room. For this to be carried out satisfactorily the fan should rotate at reduced speeds if the air is not to give one a sensation of chill, and this is readily accomplished by the new economizer, which not only performs its function simply and noiselessly, but is usually found to be more economical than if the speed switch be used. There are many other uses for this device.

Fig. 1.—Unique Electrically Operated Lift Bridge at Portland, Ore., With "Shasta Limited" Train Crossing Lower Deck.

Electrically Operated Lift Bridge of Unique Design.

The vertical lift bridge over the Willamette River at Portland, Ore., is a unique electrically operated structure. The lower deck provides for a double-track railway in a roadway 32 feet 8 inches in the clear. The upper deck provides for a double-track street railway in a roadway 29 feet 3 inches in the clear between trusses, besides two cantilevered roadways for vehicle traffic and two sidewalks for pedestrian traffic.

To allow passage of tugs and other small river boats, the lower deck is raised as shown in Fig. 2. This does not interfere with traffic on the upper deck. To permit the passage of high-masted sailing vessels or steamers, the lower deck telescopes with the upper deck and both are raised to a clear height of 140 feet above high water. The lower lifting deck is raised to its full height or lowered in 30 seconds and

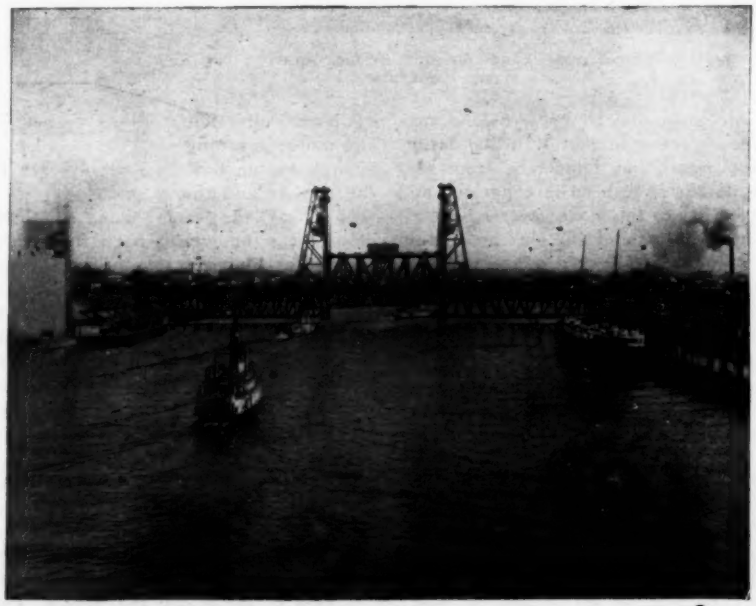


Fig. 2.—Portland Lift Bridge With Lower Deck Raised for Tugs and Small Craft Without Interrupting Traffic on Upper Deck.

both decks are then raised to their full height or lowered in 60 seconds.

The entire operation is electrical, direct-current motors using 500-volt street-railway current being used. The control of the movement of these decks is all in the hands of one man who opperates a master remote-control drum. A magnetic-switch panel which obeys the command of the master drum, controls the actual current for the motors. The control equipment, the control panel of which is shown in Fig. 3, was made by The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The bridge was designed by Waddell & Harrington, consulting engineers, of Kansas City, Mo.

Johnson Electric Washer.

The Johnson new improved electric washer is generally recognized as one of the most satisfactory washing machines on the market. In its design many small, but important labor-saving details have been incorporated and the efforts of the manufacturer have all been concentrated on the production of a simple, efficient machine that will do the family washing in the shortest possible time with the least expenditure of the housewife's energy.

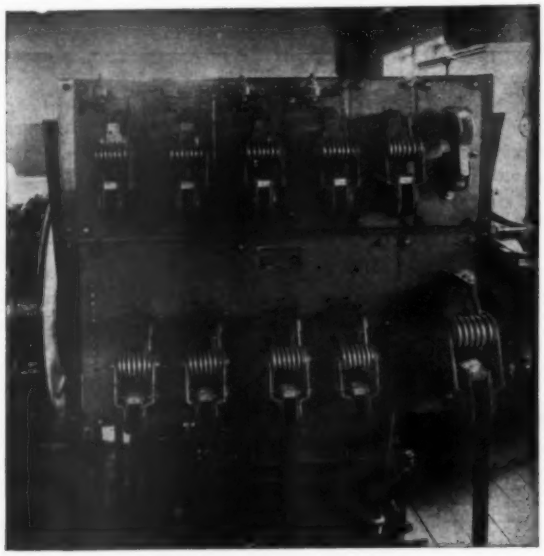
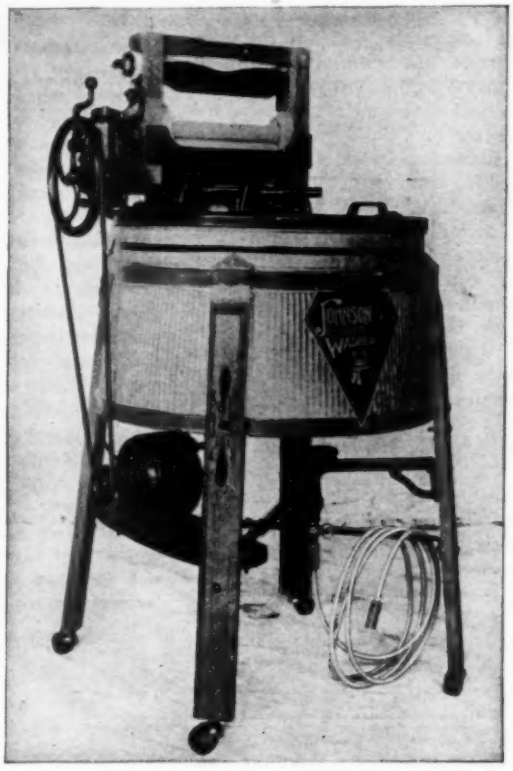


Fig. 3.—Motor-Control Panel for Lift Bridge Governed by Remote Master Controller.

It is said to be the only rotary electric washer that stands high enough to be used alongside of the ordinary stationary wash tub, allowing clothes to be passed directly from the washer, through the wringer and into the rinse water. Six feet of hose is furnished with the machine, through which hot water is carried into the washer or the dirty water drained from the machine, thus eliminating all lifting of water. The outlet is located in the center of the tub, allowing all the water to be drained. The tub is made of rust-proof galvanized steel; it is sanitary and will last for years. A gas burner and ten feet of metal gas tubing are furnished with each machine, affording an economical and convenient way of heating the water.

Each machine is operated by a Westinghouse electric motor which is mounted so that it can be disconnected in an instant and used for other purposes. The cost of power at average rates for an ordinary family washing will not exceed three cents. The power transmission is made of steel and requires no attention except an occasional oiling.

Control is very simple; by shifting a small lever, the wringer can be made to run in either direction. The motor is strong enough to run both the washer and the wringer at the same time, so that clothes can be wrung back from the rinsing or bluing water while a tubful of clothes is being washed.



Johnson Motor-Driven Washer and Wringer.

The machine is quiet, clean, safe and durable. All parts are standard, and repair parts can be furnished on short notice. The washer is made by the Johnson Electric Washer Company, San Francisco, Cal.

Voting by Electrical Apparatus.

A bill has been introduced in the Massachusetts Legislature which provides for the installation of an electrical system of recording votes and roll-calls of the members of the House and Senate. On March 18 Frank L. Dyer, inventor and patentee of the Dyer Electrical Voting Apparatus, described the construction and mode of operation of this device before the joint Committee on Rules, Speaker Cox of the House of Representatives presiding. Mr. Dyer said the apparatus has been favorably considered by the National House and might have been adopted except for the crowded condition of the calendar, which necessitated its going over until next session.

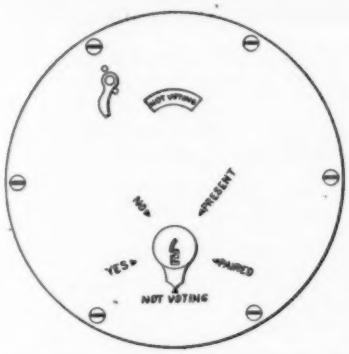
By the use of the Dyer system an entire vote can be taken and recorded in one or two minutes, whereas now about 20 minutes is consumed. It was stated that the Massachusetts House session of 1914, with 240 members, had 204 roll-call votes, consuming 68 hours, or 8.5 days of eight hours each for every one of the members—a total of 2,040 days for one man.

Merits claimed for the apparatus, beyond the saving of time, are that it enables votes to be taken which will faithfully record the personal decision of each member without regard to the vote of fellow members who may have voted before his turn; that it obviates mistakes, being as accurate as an adding machine; and that a printed copy and as many carbon copies as may be desired are provided as a record of the vote.

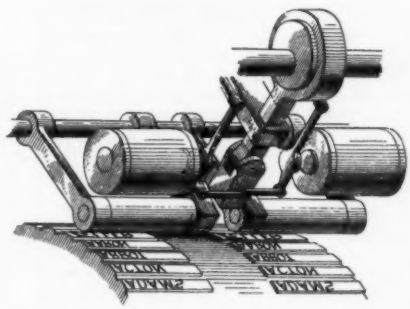
Briefly described, the construction of the apparatus is as follows: At each member's desk is a transmitter, which is a mechanism contained in a small metal box four inches square and two inches

deep, in the face of which is a Yale lock. Each member is provided with the key to his own instrument, thus obviating risk of another voting in his place.

Around the barrel of the lock are the words "Yes," "No," "Present" and "Paired," with which a pointer co-operates, mounted so as to move with the lock barrel. The member voting inserts his key in the lock, and turns it until the pointer comes to the desired word. At the same time, at a small glass-covered opening in front of the transmitter appears the proper word, assuring the voter that the right vote is being recorded.



Front View of Member's Voting Box, Dyer's Electrical Voting System.



Partial View of Electric Printing Mechanism of Vote Recorder.

The lock is now returned to the initial point and the key removed, and the pointer remains opposite the designation of the vote. At any time before the vote is actually collected the member may change his vote, by pressing a push-button switch in the front of the transmitter, which releases the pointer, and the latter is returned automatically to the initial point.

After the time for voting has expired, the receiving apparatus is started by the throw of a hand switch at the clerk's desk, which connects a new set of circuits.

The receiver is located in the legislative hall or in a separate room, and comprises four sets of printing plates, each consisting of an alphabetical list of names mounted in the form of an endless band, arranged to be fed with a step-by-step motion. Co-operating with each list of names is a printing roller which, when pressed down, will print the required name on a sheet of paper. Each name being repeated five times in parallel lines, one of the five votes is printed.

Moving mechanisms are so arranged that when the name of a member comes beneath the printing roller of each list, that member's transmitter will be put in electrical communication with the receiving apparatus, and by means of simple polarized relays the proper one of the five printing rollers will be selected, corresponding with the desired vote, that roller alone being operated, so that the member's name will be printed in its correct alphabetical sequence. When the votes are all recorded, there will be five alphabetical lists, with carbon copies as desired, of all the votes under each head. The printing roll is so arranged that new names can be introduced in alphabetical position, or removed if desired. A simple process of changing the connections allows for the change of a member's seat.

Back of the presiding officer are four registers, on which the groups of votes are indicated and totalized. The registers are connected electrically with the receiving apparatus, so that when any printing roller is operated it will actuate the corresponding register. When all the votes are collected there will be not only the printed lists referred to but also the footings on the register, clearly legible from the members' seats.

YES	NO	PRESENT	PAIRED	NOT VOTING
Aaron				
Abbott				
			Acton	
	Adams			
	Aetna			
	Afton			
		Agnew		
				Ahern
				Ailer
Ajax				
Aker				
	Alman			
			Ament	
		Anker		
	Appel			
Arent				
Astor				
Atlas				
Bart				
				Bent
	Bing			
	Blat			
Boss				
	Brent			
Burt				
Carr				

Typical Voting Record.

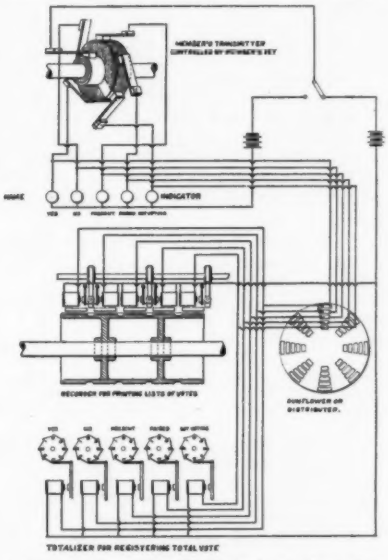
If desired, at the desks of the majority and the minority leaders, a chart or indicator may be installed with all the members' names, and opposite each name four miniature electric lamps—white, red, blue and green—to represent the four kinds of votes. These would be connected with the several transmitters so that when a member votes his vote is manifested to the party leaders, and opportunity given for change of vote before counting results.

Also, an indicator may be located in a lobby, cloakroom, or committee room. Transmitters could likewise be thus located, if desired, enabling members to vote at a distance from the chamber.

The apparatus was said to be very simple and durable. Though there are many working parts, thye are mostly of a few simple patterns, reproduced again and again. The system was claimed to be as practicable as the fire-alarm telegraph or the stock recorder, with the advantage that all the circuits are within the building and hence protected. The wear and tear of the apparatus would be practically negligible, as it operates under ordinary conditions not more than five to ten minutes a day. The electrical motive power is derived from a storage battery.

Mr. Dyer recommended that the committee members avail themselves of the advice of disinterested experts as to the practical value of the apparatus. He offered to install it at his own expense and if satisfactory the state would take it over, at a price of $15,000 to $20,000 and operate it on a royalty basis.

It was pointed out that voting by a similar process is done in the German Reichstag, the French Chamber of Deputies, and in three other European parliaments.



Circuits of Dyer Electrical Voting Apparatus.

The apparatus is covered by patent No. 701,314, granted to Frank L. Dyer. The patentee is joint author with T. Commerford Martin, of a life of Thomas A. Edison.

The committee took the matter under advisement.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CONDUIT BOXES, Floor Outlet.—Manhattan Electrical Supply Company, 17 Park Place, New York, N. Y.

Floor box with receptacle. 10 amperes, 250 volts, catalog Nos. 16431 and 16432.

Listed March 24, 1915.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—Kilark Electric Manufacturing Company, 2005 Locust Street, St. Louis, Mo.

Electrolet.

Type B. A porcelain fitting having separate opening for each wire and secured at end of conduit by threaded casting. This fitting may also be used as a service entrance bushing.

Standard for use only at exposed end of conduit (but not under fixture canopies), and only where conduit wires pass out through fitting without splice, joint or tap within fitting.

Listed March 18, 1915.

FIXTURES.—Harvey Deschere and Company, 1507 Garden Street, Hoboken, N. J.

Plaque-type Argus miniature electric sign.

A miniature electric sign consisting of a cast-aluminum base with non-interchangeable letters illuminated with low-voltage miniature lamps connected in series and shunted with proper resistance units within the base, for use on ordinary lighting circuits. Provided on order with portable reinforced or armored cord and attachment plugs or arranged to be wired at an outlet as a permanent chain fixture. Rating, 5 amperes, 115 volts.

Listed March 11, 1915.

FUSES, Cartridge Inclosed.—Kirkman Engineering Company, 173 Lafayette Street, New York, N. Y.

"K. E." cartridge inclosed fuses, 200 amperes, 250 volts.

Listed March 23, 1915.

INSULATING PAINT.—T. J. Hadley, Brunswick Hotel, Winnipeg, Canada.

A black liquid, drying with a gloss finish and remaining soft and pliable.

Standard for use in coating wires, cables, splices and other places where an insulating paint is desirable.

Listed March 23, 1915.

MOLDING FITTINGS. — Pague Manufacturing Company, 411 South Clinton Street, Chicago, Ill.

Fittings for use with "PAGRIP" metal molding, couplings, crosses, tees, elbows.

Listed March 23, 1915.

RECEPTACLES, For Attachment Plugs.—George Cutter Company, South Bend, Ind.

Receptacle base consists of a single-piece porcelain on which are mounted three spring contacts. A hardwood plug is provided with contacts and lugs for portable cables.

Receptacle, catalog No. 22922.

Plug, catalog No. 22921.

Listed March 23, 1915.

RECEPTACLES, for Attachment Plugs.—General Electric Company, Schenectady, N. Y.

Surface receptacles, 10 amperes, 250 volts, catalog Nos. 49488, 49489, GE064.

200 amperes, 120 volts, catalog No. 147799, for use in changing batteries on electric vehicles.

Listed March 9, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" metal shell, closed or slotted bases.

Conduit box, catalog Nos. 4100 and 4101.

Also the above types with shadeholders attached.

Listed March 11, 1915.

RECEPTACLES, Standard.—General Electric Company, Schenectady, N. Y.

G. E. wall sockets, brass shell.

Pull, 660 watts, 250 volts, catalog Nos. GE588-92 inclusive, GE610, GE613-22 inclusive.

Also above types with shadeholders attached.

Listed March 19, 1915.

RECEPTACLES, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

Porcelain shell. P. & S. Keyless. 1500 watts, 600 volts, catalog Nos. 520, 523.

Listed March 8, 1915.

RECEPTACLES, Standard.—Weber Electric Company, Schenectady, N. Y.

Porcelain shell.

Key, 250 watts, 250 volts, catalog Nos. 1728, 1731, 1734, 1737, 1740, 1743, 1746, 1749, 1752, 1755, 1758, 1761, 1764, 1767, 1770, 1773.

Keyless, 660 watts, 250 volts, catalog Nos. 1729, 1732, 1735, 1738, 1741, 1744, 1747, 1750, 1753, 1756, 1759, 1762, 1765, 1768, 1771, 1774.

Pull, 250 watts, 250 volts, catalog Nos. 1730, 1733, 1736, 1739, 1742, 1745, 1748, 1751, 1754, 1757, 1760, 1763, 1766, 1769, 1772, 1775.

Listed March 9, 1915.

SIGNAL APPLIANCES.—W. R. Ostrander and Company, 22 Dey Street, New York, N. Y.

Bells, weatherproof type, for alarm and signaling systems, 2.5 to 16-inch sizes. Catalog Nos. 2812-2816 inclusive, and 2818-2826 inclusive, for battery circuits; and catalog Nos. 2426-2439 inclusive for other circuits of voltages not over 250 volts.

Listed March 22, 1915.

SOCKETS, Standard.—General Electric Company, Schenectady, N. Y.

G. E. brass shell.

Pull, 660 watts, 250 volts, catalog Nos. GE580-87 inclusive, GE593-95, inclusive, GE602-09 inclusive.

Also the above types with shadeholders attached.

Listed March 19, 1915.

SOCKETS, Standard.—Weber Electric Company, Schenectady, N. Y.

Porcelain shell.

Key, 250 watts, 250 volts, catalog Nos. 1701, 1704, 1707, 1710, 1713, 1716, 1719, 1722, 1725.

Keyless, 660 watts, 250 volts, catalog Nos. 1702, 1705, 1708, 1711, 1714, 1717, 1720, 1723, 1726.

Pull, 250 watts, 250 volts, catalog Nos. 1703, 1706, 1709, 1712, 1715, 1718, 1721, 1724, 1727.

Listed March 9, 1915.

SOCKETS, Weatherproof.—Henry Newgard & Company, 953 Washington boulevard, Chicago, Ill.

Types, A, B and C "Newgard" sockets with vaporproof globes.

Listed March 10, 1915.

SWITCH BOXES.—The Adapti Manufacturing Company, 919 West Street, Cleveland, O.

Cast-iron switch boxes for use with rigid conduit. Catalog Nos. 2500, 2600.

Listed March 15, 1915.

REFILLABLE FUSE.—CORRECTION.

In the issue of April 3, 1915, an item was published under the heading "Latest Approved Fittings," indicating that the ferrule-type refillable fuse, consisting of fiber shells; metal end caps; powder filler; fusible elements of zinc wire soldered to terminals in form of screws and stranded copper wire, 0-60 amperes, 250 volts, manufactured by the Multi-Refillable Fuse Company, 723 Fulton Street, Chicago, Ill., had been approved February 15, 1915, by the Underwriters' Laboratories, Incorporated.

This publication was incorrect, as the Underwriters' Laboratories has not recognized these refillable fuses as standard, nor has it issued any card of approval thereon.

Current Electrical News

ATLANTIC STATES.

AUGUSTA, ME.—The following measures have been enacted by the Legislature and received the approval of the Governor: An act to incorporate the Madawaska Electrical Power Company; an act to extend the powers of the Limerick Water & Electric Company; and an act which authorizes the Houlton Water Company to generate and sell electricity.

COLDBROOK SPRINGS, MASS.—The Coldbrook Springs Electric Light Company has just been organized with Clarence H. Parker as president. Other officers of the company are Harry B. Parker, secretary and treasurer; directors: Guy Allen, J. Edmund Cody, Gilbert P. Butterfield, J. Nelson Ball, Herbert T. Needham, Walter R. Dean and Frederick B. Kendall. A committee consisting of Guy Allen, J. Nelson Ball and Clarence H. Parker has been appointed to investigate the cost of installing a plant.

LUDLOW, MASS.—A local lighting company is proposed, to do business in this town, with the prospect of turning over its franchise to the municipality later. A hydroelectric development, at the Harris mill privilege, is projected. There is a 40-foot fall at this place.

NEW SHOREHAM, R. I.—Application for the incorporation of the New Shoreham Lighting and Power Company has been made in the State Legislature. W.

NORWICH, CONN.—The plant of the Norwich Compressed Air Power Company is about to be changed over into a hydroelectric plant. Three interests are seeking the opportunity to manufacture electricity to be sold to eastern Connecticut municipalities—the Rex Power Company, the Co-operative Power Company and the Compressed Air Power Company itself. The two former are seeking a charter, and the latter is about to ask for an amendment of its charter, giving it the right to generate electricity. Its attempt to produce compressed air as power resulted in financial loss.

NEWARK, N. J.—The Shade Tree Commission will soon call for bids for the installation of new electric light standards at McKinley Circle, Clinton, Belmont and Madison Avenues. A.

PERTH AMBOY, N. J.—The Board of Aldermen is considering the installation of a new street-lighting system, forming a "white way," along Smith Street. A.

WESTON, W. VA.—The city council has granted a franchise to Malloy Brothers, to erect and maintain an electric light and power plant for the city of Weston and outlying suburbs.

WINNSBORO, S. C.—The city voted $80,000 in bonds for an electric light plant, waterworks and sewer system. Address the mayor.

NORTH CENTRAL STATES.

CANTON, O.—The Sun Vapor Street Light Company has offered to install 52 side lights in Duebar Street, the lighting of which is under consideration by the city council, and to light the thoroughfare for $1,650.. The Canton Electric Company has submitted an offer for the lighting of the street, also, and both propositions are under consideration by the light committee of the council. The Sun Vapor Company offers either to sell or rent the lights to the municipality. L.

FREEMONT, O.—Budd J. Jones, receiver for the Sandusky River Power Co., has been ordered by the common pleas court to dispose of the company's hydroelectric plant in this city, in order to enable it to pay off mortgages to the amount of $375,000 held by the Cleveland Trust Company. The sale will be made as soon as an adequate offer for the plant can be had.

NEWARK, O.—Newark voters defeated the proposition to issue bonds in the sum of $30,000 to reconstruct the municipal electric light plant.

MINNEAPOLIS, MINN.—The installation of a large number of additional arc lights in the residence districts is to be undertaken in the near future, as a result of an action of the council. The public lighting committee recently announced a meeting for the consideration of requests for additional lighting. Requests at once came in for the installation of 280 additional arc lamps. The city is to supply as many of these at once as the lighting fund will allow and more will be added as soon as money is available.

STAPLES, MINN.—Arrangements are being made for the installation of a new street-lighting system here within the next few months. It is proposed to use 600-candlepower lamps.

PARKER, S. D.—A petition has been circulated requesting the city commissioners to issue warrants up to $5,000, for the purpose of extending the operations of the electric lighting plant.

JEFFERSON CITY, MO.—An order has been issued by the Public Service Commission authorizing the sale by the Caruthersville Ice and Light Company of Caruthersville and the Kennett Ice and Electric Company to the Caruthersville and Kennett Light and Power Company. The amount to be paid for the Caruthersville plant is $175,000 and for the Kennett plant, $75,000.

KANSAS CITY, MO.—It is reported that a bond issue of one and one-half million dollars for a municipal electric light plant may be included in the list of issues planned in Kansas City, which now amounts to nearly $4,000,000. The ordinance leading up to the bond election is now being considered by the city council. M.

SOUTH CENTRAL STATES.

ELIZABETHTOWN, KY.—Establishment of electric light plants in Sonora and West Point, Ky., is being considered by the Greenup Electric Company, which recently filed articles of incorporation in this city, listing capital of $10,000. The charter authorizes the company to issue $30,000 in bonds. The Greenup Company owns and operates the lighting plants at Stithton, Horse Cave, Munfordville and Brandenburg, Ky., and also holds interests in plants at Edmonton and Burkesville, Ky.

WHITESBURG, KY.—An electric light franchise has been granted by the city council to the Starkey Electric Company, of Somerset, Ky., which is to exercise its franchise rights immediately.

MANCHESTER, TENN.—Plans are being made by the Tennessee Valley Light and Power Company to construct a line from Winchester to Manchester, supplying this city with electricity. This company recently acquired control of the local plant, and will overhaul it, so that much more power can be rendered available. The local offices of the company will be in charge of H. W. Foote.

STUTTGART, ARK.—F. L. Wilcox, Syndicate Trust Building, St. Louis, is preparing plans for an electric light plant and waterworks; estimated cost, $100,000.

JENNINGS, OKLA.—The Gate Electric Light and Power Company has been organized here with a capital stock of $5,000. William E. May is interested in the project. D.

LONGVIEW, TEX.—The plant of the Longview Ice and Electric Company, which was recently purchased by the American Public Service Corporation, will be improved. D.

LULING, TEX.—The Texas Light and Power Company is negotiating with the city council with a view of furnishing the town with electric lights and power. D.

MADISONVILLE, TEX.—The city is considering the installation of electric light plant. Address the mayor.

MARFA, TEX.—B. Q. Musgraves, of Fort Worth and associates, plan to construct an interurban electric railway between Marfa and Fort Davis, 18 miles. It is proposed to extend the line from Fort Davis to Balmorhea, an additional thirty miles, later on. The building of an electric power plant is involved in the project. D.

POST, TEX.—An electric lighting system will be installed here by the Post Power Company. D.

WESTERN STATES.

ALBUQUERQUE, N. M.—The Las Cruces Electric Light and Ice Company has submitted to the city of Las Cruces a proposition for an all-night electric service.

LORDSBURG, N. M.—W. F. Ritter has purchased the holdings of the Lordsburg Electric, Ice and Water Company. New equipment is being installed. The water supply will be augmented. D.

ALBION, WASH.—M. C. Osborn, commercial agent of the Washington

Water Power Company, Spokane, is negotiating with the city council here for a contract for street lighting. If the council grants the franchise petitioned for, the company will extend its transmission lines from Pullman. The line proposed from Pullman, to Albion, will serve ranches between the two towns. O.

CHELAN, WASH.—It is reported officially that the Great Northern Railroad Company will build a temporary power plant here this spring, which will be used to pump water for irrigation purposes in this vicinity and also for use when the railroad company begins work on the big water dam to be constructed at Lake Chelan. Chief Engineer Budd, of the Great Northern, has made the preliminary investigations, tnd he announces that construction work will be started within a very short time.

SEATTLE, WASH.—The Board of County Commissioners, King County, here, M. J. Carrigan, chairman, will receive proposals and competitive designs for furnishing and installing electric fixtures in the new King County courthouse under construction on the block bounded by Fourth and Third Avenues and James and Jefferson Street. The work is to cost approximately $25,000. Schedules and specifications may be obtained at the office of the King County Commissioners, Court House, or from A. Warren Gould, architect, American Bank Building, here. Bids will be received until May 3. O.

SEATTLE, WASH.—The Cedar River power plant at Cedar River, Seattle's municipal lighting and power source, was put out of commission on April 5, by the breaking of both the four and six-foot power pipe lines, at a point between the new masonry dam and the old timber dam. Until the damage has been repaired, the entire light and power load of the plant will be handled by the Lake Union steam plant and the hydroelectric plant operated by the overflow from the Volunteer Park reservoir, both located in Seattle. City Engineer A. H. Dimock officially announced that he has abandoned the idea of puddling or silting the leaking storage basin back of the dam, as the means of making the porous bank hold water. Dimock favors the construction of a concrete wing wall, a distance of nearly a mile and a half through the porous or glacial north bank of the Cedar River. The cost of this is problematical, but it is admitted that it will be between $1,000,000 and $1,500,000. Engineers of the City Lighting Department and City Engineering Department are making investigations at this time, and immediate steps will be taken to repair the damaged pipe lines. O.

PASADENA, CAL.—A resolution has been adopted by the City Commission for the installation of an ornamental lighting system in North Fair Oaks Avenue.

SAN BERNARDINO, CAL.—Property owners on Third Street are preparing for the installation of an ornamental street lighting system.

VENTURA, CAL.—Representatives of the Ventura County Power Co. are to confer at an early date with the Board of Trustees of this city regarding additional street lighting service.

HONOLULU, HAWAII.—The Supervisors have adopted a resolution proviuing for the appropriation of $34,000 for an electric light plant and police-signal system.

PROPOSALS.

LAMP STANDARDS, LANTERNS, ETC.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until April 24, for lamp standards, lamp brackets, lanterns, etc., in accordance with drawings and specifications which may be obtained from that office.

ELECTRIC DUMB-WAITER.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until May 4, 1915, for the installation of an electric push-button dumb-waiter in the United States post office at Minneapolis, Minn., in accordance with drawing and specification, copies of which may be had at the office of the Supervising Architect, Washington, D. C.

PERTH AMBOY, N. J.—The Board of Aldermen will receive bids up to 8:30 p. m., April 26 for the erection of a municipal electric lighting plant. Proposals may be entered for any or all of the following items: (1) Power Station Building, including traveling crane; (2) Oil engines, generators, switchboards, constant-current transformers, pumps, station heating and wiring of apparatus, and electric lights in building; (3) Electrical work, including outside distributing system, both overhead and underground construction. Bids to be addressed to Wilbur La Roe, City Clerk. Runyon & Carey, consulting engineers, 845 Broad Street, Newark, have prepared plans and specifications. A.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received at the office of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 27, for furnishing 5,000 feet of flexible insulated cable, schedule 8131; four generator sets, Schedule 8130, for delivery at Navy Yard, Philadelphia.; 4,500 feet interior communication cable; 400 receiver cords for radio headgears; miscellaneous type A stuffing tubes; 5,000 feet plain single-conductor wire; 150,000 feet plain twin-conductor wire; miscellaneous magnet wire; 2,300 feet rat-tail wire; Schedule 8148, all for delivery at Navy Yard, Brooklyn, N. Y. Also 75,000 feet incandescent-lamp cord; miscellaneous lighting and power wire; 4,500 pounds weatherproof wire; Schedule 8147, for delivery at Navy Yard, Brooklyn, N. Y. Also 3,000 feet weatherproof cable, Schedule 8143, for delivery at Navy Yard, Washington, D. C.; miscellaneous motor generator, etc., Schedule 8163, for delivery at Navy Yard, Brooklyn, N. Y.; 540 porcelain insulators, Schedule 8146, for delivery at works of manufacturer. Bids to be received until May 4, on the following: Two electric food and meat grinders, Schedule 8171, for delivery at Navy Yard, Norfolk, Va.; two induction motors, Schedule 8169, for delivery at Navy Yard, Washington, D. C.; miscellaneous switchboards, etc., Schedule 8164, for delivery at Navy Yard, Puget Sound, Wash.; miscellaneous transformers, Schedule 8164, for delivery at Navy Yard, Puget Sound, Wash.

NEW PUBLICATIONS.

AUTOMOBILE LIGHTING GENERATORS.—Part I, No. 1 of Vol. II of *Washington University Studies* contains an article by A. S. Langsdorf entitled "Operating Characteristics of a Self-Regulating Automobile Lighting Generator." The subject is treated mathematically.

PUBLIC-UTILITY ECONOMICS.—The series of ten lectures which was delivered before the West Side Young Men's Christian Association in New York City in 1913-14 has been published in book form by the Finance Forum of the Association. It comprises 195 pages and is provided with an index.

BOILER CONSTRUCTION CODE.—The American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York City, has issued in the form of a 114-page pamphlet the "Rules for the Construction of Stationary Boilers and for Allowable Working Pressures." compiled by its Boiler Code Committee. The primary object of these rules is to secure safe steam boilers. The committee worked on the subject over three years, collaborating with engineers and representatives of boiler manufacturers and boiler users. The code of rules has been approved by the Council of the Society. It is being used already as the basis of boiler legislation in several states. Copies of the code can be obtained by non-members for $0.80 each.

FOREIGN TRADE OPPORTUNITIES.

[Addresses and other information may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each opportunity and give file number.]

NO. 16,233. ELECTRICAL SUPPLIES.—An American consular officer in Spain reports that a business man in his district has requested that he be supplied with samples, prices, etc., on electrical supplies for continuous current, voltage 110 to 130. He is especially interested in attachment plugs, etc., contacts, switches, sockets of all kinds, insulated wires, flatirons, warming pads, and various other kinds of heaters. Quotation units should be stated, and weights given per quoted unit in metric system. It is stated that United States bank reference can be given. Correspondence must be in Spanish.

NO. 16,259. INNER GLOBES FOR ARC LAMPS.—An American consular officer in England reports that a firm in his district desires to be placed in communication with American manufacturers of inner globes, heat-resisting glass, for arc lamps. Prices should be stated c. i. f. British ports.

NO. 16,290. INCANDESCENT LAMPS.—A business man in France informs an American consular officer that he desires to be placed in communication with American manufacturers of incandescent lamps.

NO. 16,302. MAGNETOS.—One of the foreign legations in Washington, D. C., informs the Bureau of Foreign and Domestic Commerce that an automobile manufacturer is desirous of forming commercial relations with firms in the United States which are in a position to supply magnetos to be used in the manufacture of one, two and three-cylinder motor cars.

NO. 16,315. ELECTRIC FURNACES, ETC.—The Bureau of Foreign and Domestic Commerce is in receipt of a communication from a business man in New York City stating that his correspondent in Spain is in the market for machinery for making wire fencing and barbed wire, and electric furnaces for making calcium carbide.

NEW INCORPORATIONS.

BOSTON, MASS.—The Hotel Door Signal Company has been incorporated with a capital stock of $25,000. The incorporators are George W. Gill, Allen C. Jones, Frank W. Morris.

HARTFORD, CONN.—The Northern Connecticut Light and Power Company has petitioned the Legislature for authority to increase its capital stock from $500,000 to $1,000,000. The company supplies gas and electricity to Windsor, Windsor Locks, Suffield, Thompsonville and Hazardville, Conn.

ATHENS, GA.—The Jefferson Electric Company, Jackson County, has applied for a charter to erect and operate electric plants and lines in and around Jefferson, the county seat of Jackson County. The capital to begin with is $10,000.

NEW YORK, N. Y.—The Duzets Company. Incorporated; to manufacture appliances connected with electrical power plants, etc. Capital $5,000. Incorportors: Ralph A. Koontz, Harry J. Neuschafer and Clarence S. Ashley.

CLEVELAND, O.—The Stern Electric Company has been incorporated with a capital of $10,000; electrical equipment. Incorporators: Alexander Dombrosky. Benjamin Stern, Kirk C. Schaible, John Marshall Hand and Henry B. Steuer.

ONEONTA, N. Y.—Colonial Electric & Manufacturing Company, Incorporated; to manufacture electrical appliances, etc. The company is capitalized at $35,000, and the incorporators are W. F. Eggleston, Joseph S. Lunn and A. E. Ceperlry, all of Oneonta.

INDIANAPOLIS, IND.—The Electric Furnace Company of America has been established with a capital of $30,000, to manufacture furnaces. The directors are Henry H. Buckman, Jr., George A. Pritchard and Thomas E. Buckman.

MILLTOWN, IND.—The Electric Service Company has been established with a capital of $5,000. The directors are David S. Cook, Harry Lemmon, Henry S. Gray and others.

KOKOMO, IND.—Scott, Drinkwater, Scott Company; capital, $10,000; electrical appliances. Directors, C. O. Scott, C. M. Drinkwater and W. V. Scott.

RANKIN, ILL.—Rankin Electric Light Company; capital, $5,000; to manufacure and sell electrical current for light and power. Incorporators: Charles J. Crump, Catherine Crump and Charles Morrow.

SMITHVILLE, TENN.—The Keltenburg Telephone Company, of De Kalb County, has been incorporated with a capital of $100,000, by V. V. Adcock, Thomas Reynolds and others.

BRIDGEPORT, CONN.—The Lordship Company, Inc., has been organized to control and operate electric railway lines now under construction between this city and Lordship Manor, and central amusements at that resort. A concrete car barn, at a cost of $60,000 will be erected, and power will be bought from the Connecticut Company. One hundred and fifty bath houses will be erected at the Manor. The capital stock of the company is $500,000. Prominent men interested are: Walter B. Lasher, Frederick A. Bartlett and John T. Kenworthy.

FINANCIAL NOTES.

The $6,000,000 Montana Power Company first-refunding five-per-cent bonds due 1943, recently purchased by Lee, Higginson & Company, Guaranty Trust Company, and J. & W. Seligman & Company, have all been sold.

The Engineering Securities Corporation is offering $925,000 first-mortgage six-per-cent bonds of Southern Utilities Company at 98 or on a 6.20-per-cent basis. Southern Utilities Company is under the management of the J. G. White Management Corporation and gross earnings for the year ended December 31, 1914, were $1,068,297, with net earnings of $271,686 or three and a half times the interest requirements on the funded debt.

The directors of the British Westinghouse Electric and Manufacturing Company Limited report for 1914 a far better result than for any year since the company began manufacturing operations at Trafford Park, Manchester. The net profits for two years were:

1913	$532,470
1914	758,135

The preference dividend, which for 1913 was five per cent, has been increased to 7.5 per cent. It is anticipated that there will be still further satisfactory extension of business as the result of the recent acquisition by the British Company from the American Westinghouse Company of its interests in the French, and through it, the Italian Westinghouse Companies.

Marconi's Wireless Telegraph Company Limited, which a year ago declared an interim dividend of ten per cent, has announced that no interim dividend can be declared at present. It is added that the company's stations have, since the outbreak of war, been largely devoted to British government work, and for this reason the new direct public service with New York, which it had been contemplated would have been opened in the summer of 1914, has had to be postponed.

Dividends.

	Term	Rate	Payable
Am. Light & Trac.	Q	2.5%	May 1
Am. Light & Trac., pf.	Q	1.5%	May 1
Am. Light & Trac., stock dividend	—	2.5%	
Brazilian Traction	Q	1.5%	June 1
Brooklyn City R. R.	Q	2 %	Apr. 15
Com'wealth Edison	Q	2 %	May 1
Com'wealth Pr., Ry. & Lt., pf.	Q	1.5%	May 1
Com'wealth Pr., Ry. & Lt., com.	Q	1 %	May 1
Dayton Pr. & Lt.	Q	1.5%	Apr. 15
Edison Elec. Illum., Brockton	S-A	$4.00	May 1
Elec. Utilities, pf.	Q	1.25%	Apr. 15
Havana El. Ry., Lt. & Pr., pf.	S-A	$3.00	May 15
Havana El. Ry., Lt. & Pr., com.	S-A	2.50	May 15
Phila. Co.	Q	1.5%	May 1
Pub. Serv. Invest., pf.	Q	1.5%	May 1
United Elec. Sec., pf.	S-A	3.5%	May 1

Reports of Earnings.

NORTHERN STATES POWER.

Income account for year ended December 31, 1914:

	1914	1913
Gross earnings	$4,395,868	$3,887,408
Net after taxes	2,364,370	2,015,110
Interest charges	1,339,668	1,262,175
Surplus	1,024,702	752,934
Balance after depreciation and preferred dividends	*264,633	112,935

*Equivalent to 4.43 per cent on $5,975,000 common stock.

PUGET SOUND TRACTION, LIGHT & POWER.

	1915	1914
January gross	$ 670,885	$ 754,034
Net after taxes	249,235	319,400
Surplus after charges	71,096	145,501
Twelve months' gross	8,367,824	8,665,995
Net after taxes	3,373,801	3,660,898
Surplus after charges	1,250,705	1,589,778

NORTHERN OHIO TRACTION & LIGHT.

	1915	1914
February gross	$260,451	$248,006
Net after taxes	95,465	93,128
Surplus after charges	44,603	43,097
Balance after preferred dividends	27,873	28,599
Two months' gross	541,290	518,967
Net after taxes	194,325	192,797
Surplus after charges	93,212	93,304
Balance after preferred dividends	60,975	64,234

PERSONAL MENTION.

MR. R. E. CURTIS, of the purchasing department of the Boston Edison Company, was elected vice-president of the Boston Society of Civil Engineers at its annual meeting March 17.

SIR WILLIAM MARCONI was presented on April 11 with the Albert Medal of the Royal Society of Arts, of London, England. The medal is awarded annually for "distinguished merit in promoting arts, manufactures and commerce."

MR. C. S. WALLACE has been appointed superintendent of the accounting department of the Edison Electric Illuminating Company of Boston. Mr. C. M. Guilford, the former head, has been made superintendent of the correspondence department.

MR. ALECK M. MacCUTCHEON, previously with the Crocker-Wheeler Company, Ampere, N. J., has recently removed to Cleveland, O., to take charge of the design work of the Reliance Electric & Engineering Company, of that city. At the time of leaving the Crocker-Wheeler Company, Mr. MacCutcheon was engaged in the design of special motor-generator sets for use in connection with wireless installations. He was previously in charge of the estimating work of the engineering department and in executive charge of the drafting room.

MR. KENT K. STERNBERG, treasurer of the Dickinson Manufacturing Company, Springfield, Mass., who recently met with a rather serious accident in which one of his hands was

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	April 12	April 5
American Tel. & Tel. (New York)	120	119⅜
Commonwealth Edison (Chicago)	.....	138
Edison Electric Illuminating (Boston)	243	243½
Electric Storage Battery, common (Philadelphia)	50¼	48½
Electric Storage Battery, preferred (Philadelphia)	50¼	48½
General Electric (New York)	149	143½
Kings County Electric (New York)	119	119
Massachusetts Electric, common (Boston)	.....	7
Massachusetts Electric, preferred stamped (Boston)	44	46½
National Carbon, common (Chicago)	130	133
National Carbon, preferred (Chicago)	119¾	119
New England Telephone (Boston)	132	132
Philadelphia Electric (Philadelphia)	24	23¾
Postal Telegraph and Cables, common (New York)	76	75
Postal Telegraph and Cables, preferred (New York)	67½	67½
Western Union (New York)	66	65¾
Westinghouse, common (New York)	77⅛	73¾
Westinghouse, preferred (New York	120	119

seriously burned, has almost entirely recovered. His hand will soon be as good as ever. The company has recently closed some very large orders for its products from several large national electrical manufacturing companies for high-tension work. The company reports general business particularly good at this time.

MR. A. J. BURNS, secretary of the Missouri Electrical Contractors' Association, when city electrician of Kansas City, Mo., some 10 years ago, protested vainly against special privilege ordinances, under which previous ordinances and rules were violated with impunity. His contention was that such legal immunity was not right, whether it was legal or not. The Missouri Supreme Court has recently decided that such special ordinances are invalid—and the building code and city laws will now have to be obeyed by everybody. It is probable, however, that work done under special privilege ordinances will not be disturbed.

MR. W. W. FREEMAN, president of the Union Gas & Electric Company, Cincinnati, O., is one of the members of a committee composed of 150 of the leading business men of the city, appointed by President T. C. Powell, of the Chamber of Commerce, to act in an advisory capacity in connection with the most sweeping "clean-up" campaign which the city has ever had. One of the principal duties of the committee is to devise a system of uniform street lighting of an ornamental nature, which is now very much lacking, and action along this line is likely to be taken and pushed to completion very shortly. Standard street signs, illuminated at night, are also to be suggested by the committee, with other matters tending to the better appearance of the streets.

MR. RAY D. LILLIBRIDGE, one of the leaders in the present field of technical advertising, secured his first position in the business world as an office boy in the Wall Street office of a New York mercantile company twenty years ago. Later in the same year, he secured another office-boy position, which happened to be in the advertising business. The following year he undertook the editing of a small newspaper directory, and this work proved a liberal and at the same time concentrated education in the business of advertising. After the book was published, he secured a position as advertising manager with a manufacturing company, and during the next three years held two other positions as advertising manager with manufacturers in the technical class, going up the ladder with every change. With an office of his own at 20 Broad Street, New York, at the close of the year 1899, Mr. Lillibridge took on the advertising accounts of a number of concerns noncompetitive with one another, proposing to serve each in the same capacity and on the same basis as he had served the three individual manufacturers previously. It is interesting to know that his first client was Albert S. DeVeau, a manufacturer of telephones. Before the close of the year following, his clientele included the American Bridge Company, Electric Storage Battery Company, Link Belt Engineering Company, the Stanley Electric Manufacturing Company and Otis Elevator Company. Mr. Lillibridge's connection with the technical advertising field has been one of great interest and significance. His business is founded upon the principle that a salary or per diem charge is the correct method of remuneration for advertising advice and direction, breaking away from precedent and eliminating commissions. He maintains that there are in the technical field many companies which, in point of capital, gross business or net earnings, compare favorably with national advertisers, yet whose advertising expenditures are modest by comparison. Through Lillibridge's plan, several such companies can join and have the advantage of unbiased expert advertising advice which previously was available only to the great national advertisers, whose advertising appropriations justify the exclusive maintenance of a high-salaried advertising manager. That his principles are sound and recognized for their merit is indicated by the representative character of his clients. The business was incorporated under the name of Ray D. Lillibridge Incorporated, in 1909, and is so conducted at the present time at 111 Broadway, New York City. Among his electrical clients, there are now included the Wagner Electric Manufacturing Company, Kerite Insulated Wire and Cable Company, Monitor Controller Company, Sangamo Electric Company, General Lead Batteries Company and The Bryant Electric Company. Everyone connected with the industry or in any other manner familiar with the literature distributed by these companies, is cognizant of the great ability that Mr. Lillibridge evidences in the production of technical advertising media. Many of his productions are classics of their kind. Mr. Lillibridge was born in Hinckley, Minn., in 1878, and was educated at the Brooklyn, N. Y., public schools. He is a director and officer in several industrial and public utility corporations; a member of the National Electric Light Association, and of the American Electric Railway Association; an associate member of the American Society of Mechanical Engineers and of the American Institute of Electrical Engineers. He is a member of the New York Athletic, Engineers', Drug and Chemical, Columbia Yacht and the St. Louis Racquet clubs.

Ray D. Lillibridge.

OBITUARY.

MR. ALEX M. WORTHINGTON, who until three years ago was general manager of the Louisville Lighting Company, died at the home of his daughter, Mrs. Harry A. Volz, 1414 Fourth Street, Louisville, Ky., of heart disease. He was connected with the Louisville company for twenty years when he retired, shortly before the merger was effected, on account of ill health. Mr. Worthington was born in St. Louis 58 years ago, located in Covington in his youth and engaged in the electric lighting business. His wife, daughter and two sisters survive.

MR. ARTHUR L. KELLEY, president, Narragansett Electric Lighting Company, Providence, R. I., died at his home in that city, April 7, aged nearly 57 years. He was born in Canton, N. Y., and attended the local schools. For two years he published an amateur paper. Later, removing to Lawrence, Mass., he attended the local High School and Phillips Andover Academy, where he graduated in 1876. Mr. Kelley came to Providence as treasurer of a textile company, and organized the Mechanical Fabric Company. He was president of the American Card Clothing Company, and since 1908 has been head of the lighting company. He was a director of the D. & W. Fuse Company and numerous other companies.

MR. GEORGE W. PRENTISS, a manufacturer of wire at Holyoke, Mass., died April 2 at his home in that city, after a long illness. Mr. Prentiss was born in Claremont, N. H., in 1829, of a family which early came from England and settled in Cambridge, Mass. He went to Holyoke in 1857 and established the George W. Prentiss Company, one of the leading wire concerns in the field. Several years ago he retired from active business. The deceased at times served on the Board of Aldermen and the Sinking Funk Commission of his city. He was president of the Holyoke Savings Bank for nine years, and had been a director of the Holyoke National Bank and the Third National Bank of Springfield, Mass. A son, who is a partner in his concern, and a daughter, survive.

DATES AHEAD.

Iowa Section, National Electric Light Association. Annual convention, Keokuk, Iowa, April 20-22. Secretary, W. H. Thompson, Jr., Des Moines, Iowa.

American Electrochemical Society. Annual meeting, Hotel Chalfonte, Atlantic City, N. J., April 22-24. Secretary, J. W. Richards, South Bethlehem, Pa.

American Physical Society. Bureau of Standards, Washington, D. C., April 23-24. Secretary, A. D. Cole, Columbus, O.

Arkansas Association of Public Utility Operators. Annual meeting, Little Rock, May 11-13. Secretary, W. J. Tharp, Little Rock, Ark.

Arkansas Association of Electrical Contractors. Annual meeting, Little Rock, May 12-13. Secretary, J. C. Dice, Little Rock, Ark.

Gas, Electric and Street Railway Association of Oklahoma. Fourth annual convention, Oklahoma City, May 12-14. Secretary, H. V. Bozell, Norman, Okla.

Southwestern Electrical and Gas Association. Eleventh annual convention, Galveston, Tex., May 19-22. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Missouri Public Utilities Association. Annual convention, Steamer *Quincy*, May 27-30. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

National District Heating Association. Annual convention, Chicago, Ill., June 1-3. Secretary, D. L. Gaskill, Greenville, O.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

Davis Slate and Manufacturing Company, Chicago, Ill., and Bangor, Pa., has issued its new electrical slate price list No. 2. This publication contains complete measurement tables covering all sizes of slabs which are ordinarily dealt with in the electrical industry, which makes it a valuable handbook for anyone interested in electrical slate.

Carbo Steel Post Company, whose main office is in the Rand-McNally Building, Chicago, Ill., has just broken ground for another manufacturing plant at Cambridge, Ohio. The present factory is at Chicago Heights, Ill. The need for the additional plant speaks well for the company's patented products, comprising chiefly steel fence posts for farmers and home owners, lighting and power-transmission poles, also anchors and augers of various kinds.

Schweitzer & Conrad, Incorporated, Chicago, Ill., announces the removal of its factory to the Deagan Building, Berteau and Ravenswood Avenues. This is one of the finest manufacturing buildings in Chicago, and the change was necessary because of the increase in the demand for S & C fuses, S & C automatic resistance horn arresters, high-voltage detectors, recording synchroscopes, reverse phase relays and other high-class patented electric specialties.

The Metropolitan Electric Manufacturing Company, Long Island City, N. Y., has appointed William Taylor western sales agent, with headquarters at the Rookery Building, Chicago. In addition to switchboards and specialties in electrical appliances, the company is the manufacturer of the well known line of Metropolitan detachable switches and receptacles. Mr. Taylor was connected with the electrical supply business in Chicago some years ago, and has a considerable acquaintance in the trade in the Central West.

Cutter Electrical & Manufacturing Company, Philadelphia, Pa., made an interesting exhibit of its famous I-T-E circuit-breakers at the electrical show held at the University of Illinois, Urbana, Ill., April 8 to 10. An assortment of these breakers were shown, equipped with overload, no-voltage, reserval, and other valuable automatic features. Among them was a specially designed breaker for direct-current, railway circuits of 1,200 to 1,300 volts. The exhibit was in charge of Linn O. Morrow, manager of the company's Indianapolis office.

Standard Underground Cable Company, Pittsburgh, Pa., has issued an illustrated booklet giving a historical review of the company, its plants and its business from its inception 33 years ago, in February, 1882. Views of the three American works of the company and of its Canadian branch are shown. Considerable space is devoted to the company's fine exhibit of wires and cables and cable accessories, at the San Francisco Exposition. The company has also issued bulletin No. 201-1 on Standard Colonial copper-clad wire; specifications are given for hard-drawn 40-per cent grade bare wire of this type.

Cooper Hewitt Electric Company, Hoboken, N. J., has reprinted in pamphlet form an illustrated article by W. A. D. Evans, which appeared originally in the *Textile World Record* under the title, "Light as a Factor of Efficiency." It deals in a thorough manner with the lighting of industrial plants (particularly textile mills) and shows the effect on the output and employees of good illumination. Correct lighting is described and considerable data given on cost of different systems and types of units. A number of illustrations are given, showing good lighting of industrial plants.

Marion Insulated Wire and Rubber Company, Marion, Ind., manufacturer of Marion New-Code rubber-covered wires, cables and cords, is now located in its new quarters in Machinery Hall, 541-557 West Washington Boulevard, Chicago, Ill. Walter C. Rardin, an electrical salesman well and favorably known to the electrical trade in the Middle West for quite a number of years, has charge of the Chicago branch. A complete line of wires, cables and cords will be carried in stock for immediate delivery to Chicago customers and for shipments adjacent to this territory. The office and warerooms are well located, being within a block of the freight terminals of several of the leading trunk roads, making the shipping facilities excellent.

The Lindsley Brothers Company, Minneapolis, Minn., has established a new general sales office in the McKnight Building, Minneapolis. Mr. R. L. Bayne has been transferred to this office from Spokane, Wash. It is the intention of the company to handle practically all of its sales, especially those in territory east of the Rocky Mountains, from the Minneapolis office. This will be quite an advantage, as it means a saving of from three days to a week in correspondence. In connection with the Minneapolis office, the company is establishing what it expects will be the largest exclusive Western pole yard east of the producing territory. There is already in stock a considerable quantity of Western poles, and it is expected that the yard will be in full operation by May 1.

Record of Electrical Patents.

Issued by the United States Patent Office, April 6, 1915.

1,134,093. Electric Battery. W. C. Bauer, Evanston, Ill. Alkaline primary battery with zinc plate, a depolarizer consisting of an organic oxidizer and a catalytically active substance and copper oxide.

1,134,106. Electric Signal System for Hospitals. M. O. Burt, Colorado Springs, Colo. Audible and visual signals controlled by three-point switches.

1,134,107. Apparatus for the Treatment of Sewage. T. Craney, Bay City, Mich. Electrolytic process with a series of cells.

1,134,119. Cable Armor. H. R. Gilson, assignor to National Metal Molding Co., Pittsburgh, Pa. Inner and outer steel tapes with interlocking portions.

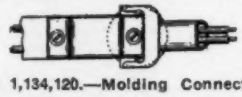
1,134,120. Connector for Wood to Metal Molding. H. R. Gilson, assignor to National Metal Molding Co. Consists of an arch-shaped insulating block with tongue extending from the roof to form a pair of wire-receiving grooves connecting with the end of the metal molding, the tongue being attached to the wood molding. (See cut.)

1,134,127. Crystalline Ferrosilicon Product and Method of Making the Same. H. C. Harrison, Lockport, N. Y., assignor to Electro Metallurgical Co. Produced in an electric furnace by maintaining the temperature at or above critical value.

1,134,128. Ferrosilicon Product and Method of Continuously Producing the Same. H. C. Harrison, assignor to Electro Metallurgical Co. Modification of above.

1,134,132. Bracket for Show-Case-Lighting Reflectors. P. M. Hotchkin, assignor to National X-Ray Reflector Co., Chicago, Ill. For supporting a longitudinal conduit and reflector fitting from top of vertical case wall.

1,134,133. Combined Junction Box and Reflector Casing. P. M. Hotchkin, assignor to National X-Ray Reflector Co. For securing in longitudinal conduit.



No. 1,134,120.—Molding Connector.

1,134,136. Trolley Head. M. H. Kashian, Amesbury, Mass. Special bushings.

1,134,137. Device for Producing Electric Pulsations. J. F. Kelly, Pittsfield, Mass. Rotary make-and-break device.

1,134,148. Arc-Light Electrode. W. R. Mott, assignor to National Carbon Co., Cleveland, O. Flaming electrode contains a carbonate, precipitated silica and an oxide of tungsten.

1,134,196. Electric-Motor Controller. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. One of the motors is arranged for dynamic braking.

1,134,197. Dynamic-Braking Controller. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co. Method consists in exciting the stator by direct current and varying this excitation and the resistance of the rotor to a corresponding degree.

1,134,222. Portable Self-Contained Electric Plant. W. H. Palmer, Jr., Wyncote, Pa. Storage battery and dynamo mounted on skid base and switchboard carried by a swinging frame secured to the base.

1,134,230. Automatic Switching Mechanism. J. G. Roberts, assignor to Western Electric Co. For automatic telephone exchange.

1,134,236. Microphone. H. E. Shreeve, assignor to Western Electric Co. Includes thermostatic diaphragm.

1,134,244. Regulation of Dynamo-Electric Machines. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co. Control system for motor with flywheel and special excitation therefor.

1,134,256. Signaling Device. C. B. Camp, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Electromagnetically controlled horn.

1,134,257. Meter Support. F. E. Chase, Danvers, Mass. Slotted links on base permit meter to be adjusted so as to hang plumb.

1,134,264. Shoe-Ironing Apparatus. J. S. Hansen, assignor to O. A. Miller Treeing Machine Co., Portland, Me. Electric iron, bracket and control.

1,134,282. Telephone Key. G. E. Mueller, assignor to Kellogg Switchboard & Supply Co. Has electromagnetic interlocks.

1,134,308. Telephone-Exchange System. J. L. Wright, assignor to F. C. Stevens, Attica, N. Y. Automatic system.

1,134,325. Door-Operating Mechanism. R. N. Flint, Washington, D. C. Motor-operated through clutch.

1,134,337. Electrical System of Distribution. A. S. Hubbard, assignor to Gould Storage Battery Co., Depew, N. Y. Includes rotary converter, storage battery, booster and regulator therefor to compel battery to equalize load.

1,134,338. Electrical System of Distribution. J. W. Jepson, Depew, N. Y., assignor to Gould Coupler Co. Train-lighting system with main generator and regulator at head end and a storage battery and regulator on each car.

1,134,345. Spark Plug. C. A. Mezger, New York, N. Y. Details.

1,134,346. Electric-Lamp Regulator. C. C. Oberly, assignor to Pullman Co., Chicago, Ill. For train lighting; has solenoid resistance control for selectively regulating generator or storage-battery current.

1,134,355. Circuit-Controlling Device. W. P. Seng, Chicago, Ill. Switch for electric horn on steering post of automobile.

1,134,356. Circuit-Closer for Motor Vehicle Electric Horns. W. P. Seng. Modification of above.

1,134,360. Signal Horn and Lamp. P. Walker, Detroit, Mich. Lamp in inner reflector and electric horn back of lamp and between inner and outer reflectors.

1,134,370. Electric Control Gear for Automatic Grab Cranes. K. Brüll, Pestszentlörincz, Austria-Hungary. Common control for driving motor and brakes.

1,134,371. Current-Supply System for Electric Railways. W. F. Byram and R. P. Phronebarger, Charlotte, N. C. Series of sectionalized contacts between the rails, the car contact shoe engaging at all times at least one contact.

1,134,402. Pneumatic-Dispatch-Tube Apparatus. J. T. Needham, assignor to Lamson Co., Newark, N. J. Remote-controlled motor drives air pump.

1,134,418. Dynamometer. J. A. Randall, Brooklyn, N. Y. Includes rheostatic contactor.

1,134,422. Electric Switch. H. F. Stratton, assignor to Electric Controller & Mfg. Co., Cleveland, O. Electromagnetic contactor.

1,134,435. Telltale System for Electric Circuits. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. Signaling system.

1,134,440. Electropneumatic Brake. J. W. Cloud, assignor to Westinghouse Air Brake Co., Wilmerding, Pa. Includes electrically controlled valve for supplying air to effect an emergency application of the brakes and for venting air from the brake pipe.

1,134,448. Elevator Signal. R. H. Gaylord and G. B. Capps, assignors to Foulkes-Gaylord Co., Los Angeles, Cal. Electric system responds to currents of different strength to give distinctive preliminary and stop signals.

1,134,452. Thermoelectric Battery for Motor vehicles. L. E. Hale, Stockton, Cal., assignor of one-half to F. C. Bolin. Utilizes exhaust heat of engine.

1,134,490. Electrical Arrangement for the Control of the Speed of Sea Engines. S. Rumolinb, Genoa, Italy. Electrically operated means governed by balance beam for cutting off fluid supply of engine.

1,134,495. Fan Attachment. R. W. Walker, assignor to E. S. Walker, Lawrence, Mass. Special air-humidifying arrangement on fan guard.

1,134,534. Automatic Electrical Switch. W. H. Hill, Oakwood, O. Electromagnetic switch for alternately making and breaking contact.

1,134,537. Self-Starter for Explosive Engines. B. F. Hutches, Jr., Allendale, N. J. Comprises a spark plug, a solenoid forming part thereof and a fuel-supply pump operated by the solenoid.

1,134,547. Circuit-Closer. W. C. Neahr, assignor to Protective Signal Mfg. Co., Denver, Colo. Vibratory contact-maker for crossing signal mounted in box below track rail.

1,134,565. Box Connector for Electric Installation. W. H. Vibber, assignor of one-half to Gillette-Vibber Co., New London, Conn. Consists of a bushing having its inner end provided with a lateral flange carrying a coupling screw.

1,134,574. Lamp. A. C. Abramson, Rockford, Ill. Portable with silk-shade support surrounding socket cover.

1,134,584. Automatic Electric Crossing Gate. J. Briggs, Los Angeles, Cal., assignor of one-half to W. T. Gunn. Operated by reversible track-circuit-controlled motor.

1,134,589. Blue-Printing Machine. E. T. Cope, assignor to Buckeye Engine Co., Salem, O. Arc lamp moves up and down in cylinder.

1,134,593. Receiving System for Electromagnetic Radiations. L. de Forest, assignor to Radio Telephone & Telegraph Co., New York, N. Y. Receiving circuit bridges across inner branch of a doubly bridged antenna circuit.

1,134,594. Means for Increasing the Strength of Electric Currents. L. de Forest, assignor to Radio Telephone & Telegraph Co. Two interconnected transformers with rotary disk cutting their lines of force.

1,134,595. Direction Indicator. H. F. Delmanhorst, Louisville, Ky. Electric lamp, reflector and movable color screens.

1,134,640. Car Signaling Device. H. Rowntree, Chicago, Ill. Opening of rear door operates motorman's signal once; closing of rear door operates signal twice.

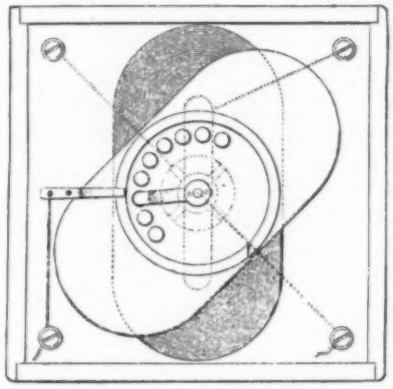
1,134,659. System of Distribution. E. C. Wright, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. One of a set of compound dynamos operating in parallel has commutating poles.

1,134,661. Electric Heating Device. McG. Allmayer, Chicago, Ill. Immersion type with food cup surrounding heating element.

1,134,673. Connector. H. A. Douglas, Chicago, Ill. Spring-pressed bayonet-type connector.

1,134,732. Electric Switch. F. P. Gates, assignor to Arrow Electric Co., Hartford, Conn. Relates to spindle of rotary switch.

1,134,739. Electric Motor Brake. A. E. Handy, assignor to Otis Elevator Co.,



No. 1,134,840.—Tuning Transformer.

Jersey City, N. J. Alongside the rotor is a rotary member inductively influenced by the stator and connected to the brake.

1,134,750. Overload Circuit-Breaker. D. Larson, assignor to Otis Elevator Co. Includes electromagnet for closing the breaker, and a doubly wound relay for opening it.

1,134,752. Motor Protecting Circuit-Breaker. J. T. Leonard, Wichita, Kans. Underload circuit-breaker for polyphase circuit.

1,134,758. Electromagnetic Signaling Apparatus. C. H. North, assignor to North Electric Co., Galion, O. Polarized telephone bells.

1,134,765. Elevator Safety or Emergency Appliance. C. Scott and A. Sundh, assignors to Otis Elevator Co. Interconnection of car switch and gripping brake.

1,134,767. Metallurgy of Copper. E. A. C. Smith, New York, N. Y. Regulated electrolytic process.

1,134,771. Means for Controlling Variable Mechanism. A. Sundh, assignor to Otis Elevator Co. Electric motor arranged to drive the transmission mechanism of automobile.

1,134,776. Induction Motor. E. Thomson, assignor to General Electric Co. Two-part squirrel-cage winding, one part having high inductance and low resistance, while the other part has low inductance and high resistance.

1,134,779. Electromagnet. A. R. Trezise, Sr., assignor to Otis Elevator Co. Plunger core moves in glass tube.

1,134,784. Vapor Electric Lamp or Rectifier. E. Weintraub, assignor to General Electric Co. Includes a co-operating electrode formed of a conducting carbide.

1,134,785. Vapor Electric Apparatus. E. Weintraub, assignor to General Electric Co. Mercury-arc rectifier with external impedence in series with one anode to prevent arcing between the anodes.

1,134,786 and 1,134,787. Rectifying Alternating Current. E. Weintraub, assignor to General Electric Co. Single-phase mercury-arc rectifier with condensing chamber having tubular arms extending outwardly and downwardly and containing anodes.

1,134,788. Electric Terminal. E. Weintraub, assignor to General Electric Co. Consists of silicon core, a metal cap and a filling of a refractory material containing silicon and aluminum.

1,134,817. Electric Furnace. J. W. Brown, assignor to National Carbon Co., Cleveland, O. Upper electrode is insulated from charge.

1,134,818. Electrical Heating Unit and Resistance-Coil. L. W. Campbell, South Yarra, Victoria, Australia. Coil wound on rod having a series of mica washers compressed together with their edges percussively united and hardened.

1,134,840. Tuning-Transformer for Wireless Systems. R. R. Goldthorp, Hartford, Conn. Comprises two flat, elongated, parallel primary and secondary coils, one arranged for rotation through 90 degrees, and a multiple-point switch for changing the effective length of each coil. (See cut.)

1,134,853. Electropneumatic Brake. C. N. Holcombe; C. Holcombe, administratrix of said C. N. Holcombe, deceased, New Rochelle, N. Y. Electromagnetic release valve.

1,134,886. Electric Stove. W. F. Merrill, New York, N. Y. Has upstanding insulating plates on which the coils are wound.

1,134,909. Way Signal. J. M. Rosselot, Cincinnati, O., assignor of one-half to B. B. Quillen. Direction-signal lamp switch controlled by steering wheel.

1,134,933. Telephone Switching Apparatus. B. D. Willis, assignor to Automatic Electric Co., Chicago, Ill. Finder switches for automatic telephone system.

1,134,951. Tachometer. T. T. Gaff, Washington, D. C. Includes electric pump to force equal quantities of fluid from the reservoir to a Bourdon spring.

1,134,954. Electric Fixture. J. E. Keough, Boston, Mass. Lamp socket with cord-clamping stud.

1,134,959. Light for Wells or Caissons. W. J. Newman, Chicago, Ill. Battery in upper compartment and lamps protected by open-bottom lower compartment.

1,134,963. Diving Bell. W. D. Sisson, Linnton, Ore. Includes a system of beams with electromagnets to hold the bell to any iron structures.

1,134,977. Pocket Flashlight. H. H. Hipwell and H. T. Hipwell, Pittsburgh, Pa. Lamp and switch at top of battery casing.

1,134,978. Semi-Automatic Telephone-Exchange Trunking System. E. A. Mellinger, assignor to Automatic Electric Co., Chicago, Ill. For connecting three-conductor and two-conductor trunks.

1,134,982. Absolute Permissive Block-Signal System. S. N. Wight, assignor to General Railway Signal Co., Gates, N. Y. Governed by combined normally closed and open circuits.

1,134,983. System of Electrical Transmission. R. A. Engler, Dubuque, Iowa. Includes singing arc lamp.

Patents Expired.

The following United States electrical patents expired on April 12, 1915:

602,142. Supply System for Electric Railways. P. J. Pringle, London, England.

602,172. Secondary Battery. F. W. Schneider, Triberg, Germany.

602,174. Telephone Transmitter. H. E. Shreeve, Boston, Mass.

602,176. Storage Battery. G. A. Washburn, Cleveland, O.

602,182. Dynamo for Electric Car-Lighting Systems. E. J. Preston and A. B. Gill, London, England.

602,208. Electric Block System. F. Burger, Fort Wayne, Ind.

602,212. Process of and Apparatus for Electrodepositing. E. L. Dessolle, Epinay, sur Seine, France.

602,218. Electric Transformer. L. Gutmann, Pittsburgh, Pa.

602,235. Electric Cord-Adjusting Device. F. N. Lawton, Summit, N. J.

602,302. Suspending Batteries on Carriages. R. T. Erougham and W. C. Bersey, London, England.

602,325. System of Electrical Propulsion for Vessels. J. J. Heilmann, Paris, France.

602,380. Electric Arc Lamp. E. Weber, Paris, France.

602,404. Electric Arc Lamp. J. Mueller, Cleveland, O.

602,413. Automatic Device for Removing Resistance in Starting Electric Motors. G. H. Whittingham, Baltimore, Md.